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ABSTRACT

The Teenage Health Teaching Modules (THTM) program is a health education curriculum for adolescents. Each THTM module frames an adolescent health task emphasizing development of self-assessment, communication, decision making, health advocacy, and self-management. This module encourages students to take a more active interest in environmental issues in their local communities and provides them with the skills to participate in local environmental decisions more fully and with more critical awareness. Five class sessions are outlined which provide students an opportunity to: (1) explore the relationship between air and water quality and human health; (2) plan a series of activities in which they will learn about air and water quality in their own community; (3) learn how pollution can travel great distances and explore a variety of national and international water and air pollution cases; (4) report on fact-finding missions; and (5) identify conservation measures they can incorporate in their personal lives and plan messages they would like to publicize or promote in their local community. Fifteen case studies dealing with water and air quality are attached. (JD)

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PRELIMINARY DRAFT
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DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service
Centers for Disease Control

Memorandum

Date · October 1983

From Director, School Health and Special Projects
Division of Health Education
Center for Health Promotion and Education

Subject Teenage Health Teaching Module
ACTING TO CREATE A HEALTHY ENVIRONMENT

To Colleagues in School Health and Health Promotion

The attached module, Acting to Create A Healthy Environment, is one of sixteen modules in the Teenage Health Teaching Modules (THTM) program. The overall goal of this health curriculum for adolescents is to provide secondary school students with knowledge, skills, and understandings that will enable them to act on behalf of themselves and others in health-enhancing ways. Each THTM module frames an adolescent health task and is designed to help students contribute to their own present and future health and well-being and that of the families, schools, and communities to which they belong.

The THTM program was produced under contract (CDC 200-79-0922) between the School and Society Programs of the Education Development Center, Inc., and the Center for Health Promotion and Education of the Centers for Disease Control.

Inquiries related to this module should be directed to this office. Write or call:

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This is one module in the Teenage Health Teaching Modules (THTM) program, a health education curriculum for adolescents developed by Education Development Center, Inc. (EDC) and funded by the Center for Health Promotion and Education, Centers for Disease Control, Public Health Service, U.S. Department of Health and Human Services.

The overall goal of the THTM program is to provide secondary school students with knowledge, skills, and understandings that will enable them to act on behalf of themselves and others in health-enhancing ways. Each THTM module frames an adolescent health task and is designed to help students contribute to their own present and future health and well-being, and that of the families, schools, and communities to which they belong.

The THTM program emphasizes development of the following health skills: self-assessment, communication, decision making, health advocacy, and self-management. For a complete description of the THTM program, additional materials, or assistance in using these materials, please write or call Teenage Health Teaching Modules, Education Development Center, Inc., 55 Chapel Street, Newton, MA 02160, (617) 969-7100. Official health and education agencies may also contact the School Health and Special Projects Office, Division of Health Education, Center for Health Promotion and Education, Centers for Disease Control, Atlanta, GA 30333, (404) 329-2829 or FTS 236-2829.

TEENAGE HEALTH TEACHING MODULES

Health Is Basic: An Introduction to the THTM Program for Teachers and Students

Understanding Growth and Development

Being Fit

Eating Well

Communicating in Families

Promoting Health in Families

Having Friends

Living with Feelings

Handling Stress

Protecting Oneself and Others: Smoking, Drinking, and Drugs

Preventing Injuries

Improving Health and Safety in the Workplace

Locating Health Resources

Using New Health Research

Acting to Create a Healthy Environment

Planning a Healthy Future

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Of the 16 modules, the following eight modules received some field testing - CHOOSING A HEALTHY WORKPLACE, PLANNING A HEALTHY FUTURE, HEALTH IS BASIC: AN INTRODUCTION TO THE THTM PROGRAM FOR TEACHERS AND STUDENTS, PREVENTING INJURIES, LOCATING HEALTH RESOURCES, PROTECTING ONESELF AND OTHERS - SMOKING, DRINKING, AND DRUGS, ACTING TO CREATE A HEALTHY ENVIRONMENT, AND PROMOTING HEALTH IN FAMILIES.

The contractor was not required to revise the modules based on this limited field test; but, we feel that it is necessary to share the reactions received with you. Listed below are the comments on ACTING TO CREATE A HEALTHY ENVIRONMENT as reported to us by the contractor in their report entitled, Eight Teenage Health Teaching Modules: A Preliminary Review, July 1983.

Review Sources: Teacher logs

1. Senior high school health/physical education (Colorado)
2. Eight grade required health (Massachusetts)
3. Seventh grade required environmental health (Minnesota)
4. Seventh grade required health (Minnesota)

Overall Reactions

Even though feedback on this module comes largely from classes just below high school level (module targeted to high school students), overall reactions to ACTING TO CREATE A HEALTHY ENVIRONMENT were positive. Teachers further commented that aspects of the module too sophisticated for junior high would, in fact, be appropriate at the targeted high school level. On the whole, the following activities and/or methods were positively evaluated: the handouts and discussion guides in Activity One, the demonstrations in Activity Three and the handouts, checklist and project in Activity Five. All four teachers using the module requested more teacher background information. Several also stated that the activities tend to take a great deal longer than the suggested times.

Issues/Ideas and Suggested Revisions

While junior high school students were reluctant to go out into the community to gather information this is less likely to be an issue for older adolescents. If it is an issue, however, alternative strategies include: the use of a resource panel put together by the teacher and the developmentof a worksheet from which students could gather information to create a profile. Both teachers from northern Minnesota flagged the difficulty of generating adequate resources in small, rural towns.

Among the specific suggestions for module changes were:

.Clarify the boundary lines between countries in the 1971 map included with Activity One to reduce student confusion.

.Inlcude more information on water availability and rain as background for Activity Two.

.Add more background material to supplement Activity Four.

Use of this module among senior high school students and/or review by teachers and other health practitioners with knowledge of this age group could yield additional information of value.

Technical Review Comments

Technical review comments on the module ACTING TO CREATE A HEALTHY ENVIORNMENT are very specific. For specifics, developers should refer directly to the revisions folder. In general, reviewers stace that the module is for the most part technically accurate and very well developed. They comment on its interesting presentation and on the use of a wide variety of education techniques. One reviewer questions the module's limited focus on air and water quality. Although these are two critical environmental issues, they are areas in which adolescents can have only a very limited impact. Area of focus suggested as possible additions or alternatives include: food protection, solid waste disposal, insect and rodent control, and healthful housing.

Concluding Comments

Preliminary review of the final eight Teenage Health Teaching Modules is larely positive. Reviewers consistently state that the modules are clearly organized and provide adequate background material for teachers. They also comment that the activity methods and content are appropriate for junior and/or senior high school students. Health educators are impressed with the variety of teaching strategies integrated into the modules, and generally feel comfortable with the teaching methods.

Contents

Introduction 1

Goals of the Module 5

Module Overview 6

Activity One: Air and Water: What Do They Have to Do with Health? 8

Activity Two: Community Environmental Profile: The Plan 23

Activity Three: Air and Water Quality Case Studies: Where People Made a Difference! 47

Activity Four: Community Environmental Profile: What We Discovered 59

Activity Five: From Knowledge to Action 62

Other Programs and Resource Materials 70

Special Thanks

We wish to acknowledge the helpful role of the American Lung Association in sharing ideas and materials with us during the development of this module.

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Introduction

Clean air and water are critical to our health and well-being, and yet the environmental threats to these precious natural resources are mounting at an alarming rate. Every day we are bombarded by new information about toxic wastes, radiation, acid rain, sulfur dioxides...the list goes on and on. Local communities are faced with highly complex problems for which there are no clear-cut solutions. Global predictions are bleak and frightening. In this kind of climate many people become discouraged, assume that all is beyond redemption, that there is little any of us can do. Others protect themselves behind a wall of apathy, insisting that there really is no problem, assuming that someone else, or perhaps some new technological breakthrough, will help solve any problems that do exist.

Acting to Create a Healthy Environment is an attempt to help students find their place in this extremely important debate. The module encourages students to take a more active interest in environmental issues in their local communities and provides them with the skills to participate in local environmental decisions more fully and with more critical awareness. Acknowledging that our environmental problems are serious, the module emphasizes the fact that the situation is not hopeless. Above all, it introduces and reinforces the concept that people, acting individually or with other concerned citizens, really can make a difference.

It is also appropriate to define how we are using the word "environment." Obviously when we talk about the need to create a healthy environment, nearly any aspect of our physical, social, or cultural world could be included. We might talk about rodent control, poverty, architecture, noise, smoking, occupational health, interpersonal relationships, or any other factor in our surroundings which bears on human health. In this module, however, we limit the discussion to our natural environment, and, more specifically, to the most fundamental parts of our natural environment: the air we breathe and the water we drink. Many factors in our political, economic, social, and cultural environments affect air and water quality, and

these will be discussed but only as they relate to air and water quality issues.

Much has been written on the important relationship between physical environment and health, but the United States Environmental Protection Agency (EPA) has formulated one of the best and most succinct statements on the nature of the challenge we now face:

> Too often, when we hear the word "environment" we think it's "out there," that we are separate from it. In reality, however, we are associated with the environment in numerous complex ways. The human body is about 60 percent water, adults breathe a minimum of 12,000 quarts of air every 24 hours, and in many less obvious ways we are clearly creatures of this planet. As our physical and social environment changes, the physical and chemical make-up of our bodies is altered. As we consume air, water and food, our bodies absorb and react to their contents. Noise and radiation also affect us. The breakdown of ecological systems mirrors our own destiny: as land, air, water and living creatures are affected by environmental mismanagement, our lives are diminished.
>
> The most important objective of environmental protection is the prevention of disease and death. When we overload natural systems with pollutants and cause illness and death through acute air pollution episodes or cause massive fish kills and threaten drinking water supplies, the relationship between cause and effect is easy to see and understand. But in the last decade we have become acutely aware of the fact that environmentally-caused death and disease can occur under much less dramatic and obvious circumstances. Moreover, since World War II our technological skill has introduced into the world new substances which are utterly alien to the natural processes of the earth. We no longer derive the chemicals we use from naturally occurring materials only--plants, animals, and minerals which evolved in the same environment in which people have always lived. Through three million years of trial and error we have learned which of these substances were edible, which were useful and which were dangerous. In the chemical revolution of the last 40 years or so, however, we have created about five million synthetic compounds--three million since 1971

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alone. About 65,000 are in commercial distribution. Most serve us well, but some pose a serious threat when used improperly, or when they enter the environment in ways that were not intended or anticipated. Some are dangerous in quantities so small that they can be detected only with sophisticated instruments capable of detecting chemicals present in parts-per-billion or even parts-per-trillion amounts. Some cause health problems many years after exposure. They provide the coup de grace to the obsolete view that land, air and water have an almost unlimited capacity to absorb pollution. Neither our bodies nor the natural environment can safely process the quantities and varieties of pollutants produced today.

Health effects related to the environment are not limited to such well-known and serious ailments as cancer, neurological damage, or heart and lung diseases. Environmental pollution also diminishes well-being, lowers human vitality, contributes to lost work time and aggravates chronic illnesses.

The economic benefits of environmental protection are many and varied. The higher the degree of protection, the greater the opportunity for individuals and their families to lead full and productive lives. Society benefits from greater productivity among workers and from lowered public health costs. The prevention of environmentally-related diseases is not free. But compared to the costs of the illnesses and deaths that protection efforts allow us to diminish or avoid, the price is surely small.*

---

*Consider the Connections (Washington, D.C.: EPA Office of Public Awareness, 1980).

Goals of the Module

The main goals of this module are:

- To demonstrate that pollution of our natural resources has severe human health consequences.
- To interest students in preventing environmental destruction and to provide them with the skills to take a more active part in environmental decision making in their local communities.
- To inform students of the global dimensions of the problem.
- To suggest concrete measures students can take to protect themselves and their families from the health consequences of pollution.
- To encourage students to practice conservation measures that will help alleviate some of the environmental problems we are facing.

Module Overview

ACTIVITY	DESCRIPTION	INSTRUCTIONAL METHOD	# OF CLASS PERIODS
One			
Air and Water: What Do They Have to Do with Health?	Students explore the relationship between air and water quality and human health.	Small-group work studying charts, maps and graphs; lecture or reading assignments	1 (part of the activity might be handled as homework)
Two			
Community Environmental Profile: The Plan	Students plan a series of activities in which they will learn about air and water quality in their own community. Homework: Students interview people in their community, as part of their fact-finding mission.	Lecture, fact sheets, development of plan for fact-finding mission	1 (plus homework)
Three			
Air and Water Quality Case Studies: Where People Made a Difference!	Students learn how pollution can travel great distances and explore a variety of national and international water and air pollution cases.	Brief demonstrations; small-group analysis of cases and reporting to rest of class	2 (could be extended if desired)

ACTIVITY	DESCRIPTION	INSTRUCTIONAL METHOD	# OF CLASS PERIODS
Four			
Community Environmental Profile: What We Discovered	Students report on their fact-finding mission.	Small-group reports, map development, whole-class discussion	2
Five			
From Knowledge to Action	Students identify conservation measures they can incorporate in their personal lives and plan messages they would like to publicize or promote in their local communities.	Class discussion	1

Activity One

Air and Water: What Do They Have to Do with Health?

Objectives

Cognitive: Students will:

- Recognize that human health is affected by the quality of air we breathe and the water we drink.
- Name at least one air pollution and one water pollution incident that have had human health consequences.

Affective: Students will:

- Increase their interest in protecting air and water quality.

Skills: Students will be able to:

- Read scientific graphs, charts, and maps.
- Draw conclusions from factual information.
- Distinguish facts from personal interpretations and conclusions.

Activity at a Glance

In groups, students study a piece of information on air or water pollution and share their understanding and interpretation of the data with their classmates. Then, either through a mini-lecture or as a reading assignment, students are introduced to an overview of the effects of air and water pollution on human health.

Preparation

1. Duplicate the five data sheets, one copy for each student:

"Major Sources of Air Pollutants"

"Per Capita Water Availability (1971)"

"Per Capita Water Availability (2000)"

"Prevalence of Emphysema in Two Cities with Contrasting Levels of Air Pollution"

"Acid Rain Distribution in the U.S."

2. Read the background information on the data sheets supplied under Procedure #5.

3. Read the background essay for students and decide whether to provide this information through a mini-lecture or duplicate and assign it for reading.

Procedure

1. Since this is the first lesson of the module, it may be helpful to give students an overview of the activities to come. You might begin by defining the word "environment" and soliciting examples of things in the environment that affect our health and our sense of well-being. Encourage students to see that almost anything can affect how we feel about ourselves and others--traffic, colors, architecture, sounds, litter, to name a few--and many things can directly affect our physical health as well: smoking (ours as well as other people's), the food we eat, stress, and the quality of the air we breathe and the water we drink. Explain that in this module we will examine the ways in which air and water pollution affect our health.

There are many causes of air and water pollution, many types of pollutants, and many ways in which they can affect our health and our sense of well-being. In this module, we will explore some of the ways air and water pollution affect health, and examine how air and water become polluted. Then we will look at some of the things we as citizens can do about it. Students will have a chance to assess their own community in terms of environmental problems and successes. Finally, the class will explore how each person can become

more involved in protecting the environment and promoting public health.

These introductory remarks should be fairly brief, (2 to 5 minutes) so that there is enough time for the main activities of the lesson.

2. Begin the first activity by announcing that you have brought with you some miscellaneous information about air and water pollution. You would like the students to take a look at it and see what they can begin to piece together about the topic.

3. Divide the class into four groups. One group should receive both "Per Capita Water Availability (1971)" and "Per Capita Water Availability (2000)." The other groups should receive either "Major Sources of Air Pollutants, "Prevalence of Emphysema in Two Cities with Contrasting Levels of Air Pollution," or "Acid Rain Distribution in the U.S." Ask each group to study its piece of information carefully and discuss it for the next ten minutes. Explain that they have two tasks: first, they must understand the facts that are presented in their data sheet, and then they must begin to draw some conclusions about or interpret the information in some meaningful way.

Be sure students understand the distinction between facts and interpretations or conclusions. If their chart, for example, shows that automobile transportation accounts for nearly twice the pollution generated by power plants, that is a fact. From this fact, one might draw the conclusion that individual automobile drivers can significantly reduce air pollution by using public transportation more often and by keeping their cars in good repair so that they give off fewer toxic fumes.

4. After students have had a chance to discuss and interpret their information, reconvene the whole class. Put two categories on the board:

FACTS CONCLUSIONS/INTERPRETATIONS

Ask members of the first group to call out as many facts as they can from what they read. Record them on the board. Then ask the same group to state the conclusions or interpretations they have drawn from the facts. List these on the board. This should all be done fairly rapidly. Don't encourage discussion yet. However, be sure that facts--and only facts--are listed as such, and that only conclusions or

interpretations appear under their heading. Repeat the procedure for the three remaining groups.

5. Take a few minutes for discussion and reflection. Encourage each group to study carefully the remarks of the other groups. Does anyone have any questions? Are the facts clear? Are the conclusions each group offered understood by other class members? What facts were they based on? How many people agree or disagree with the conclusions? Why? As you lead this discussion, encourage students to cross-examine one another in a supportive but probing way. Each group should be held accountable for explaining anything they put up on the board.

Following are examples of facts and conclusions students might mention for each of the items. Compare the statements students have made about their information with the sample statements provided. If key points have been omitted or obscured, bring them up or clarify them now.

Examples: MAJOR SOURCES OF AIR POLLUTANTS

Facts

1. Transportation is the main source of two out of five major air pollutants.

2. Power plants emit more sulfur dioxides than any other source.

3. Industry is the main source of particulates (dust and grit in the air).

4. Transportation emits three times as much carbon monoxide as all other sources combined.

5. Transportation emits as much hydrocarbons as all other sources combined.

Conclusions

1. Transportation, not industry, is the worst source of pollution.

2. Power plants are worse polluters than industry.

3. Industry may get a lot of the blame for air pollution because it produces more particulates than other sources.

4. "Other" sources, commercial and residential, need to clean up their act.

Examples: PER CAPITA WATER AVAILABILITY (1971 and 2000)

Facts

1. More of the world had large amounts of water in 1971 than will be available in 2000.

2. Among developed nations, Europe and Japan had low water supplies in 1971.

3. In North America, the northeastern and much of mid-western United States and all of Mexico will have low water supplies by 2000.

4. In developing areas such as parts of South America, Africa, and Australia, water supplies will become low by 2000.

5. The older civilized regions--China, India, North Africa, Europe--had low or very low water supplies in 1971.

Conclusions

1. As nations develop, their water needs grow. New industries use water, and a higher standard of living requires more water.

2. Development must require a lot of water.

3. Developed and developing nations need to conserve water.

Examples: PREVALENCE OF EMPHYSEMA IN TWO CITIES WITH CONTRASTING LEVELS OF AIR POLLUTION

Facts

1. People in St. Louis have more emphysema than people in Winnipeg.

2. Even young people in St. Louis may have severe emphysema.

3. People in Winnipeg do not develop severe emphysema until age 50 or older.

Conclusions

1. Air pollution in St. Louis must be worse than in Winnipeg.

2. A person could live a healthier life in Winnipeg than in St. Louis.

3. St. Louis needs to take steps to improve its air quality.

Examples: ACID RAIN DISTRIBUTION IN THE U.S.

Facts

1. The eastern half of the United States has more acid rainfall than the western half.

2. The problem worsens toward the East and especially the Northeast.

3. Rain that is most strongly acid falls near big cities like San Francisco, Spokane, Chicago, New York, and Boston.

4. Except for the areas around a few big cities, the western part of the country does not suffer from acid rain.

Conclusions

1. A person could live a healthier life in the western part of the country.

2. Something or a combination of things must cause acid in rain to build up more in the eastern United States.

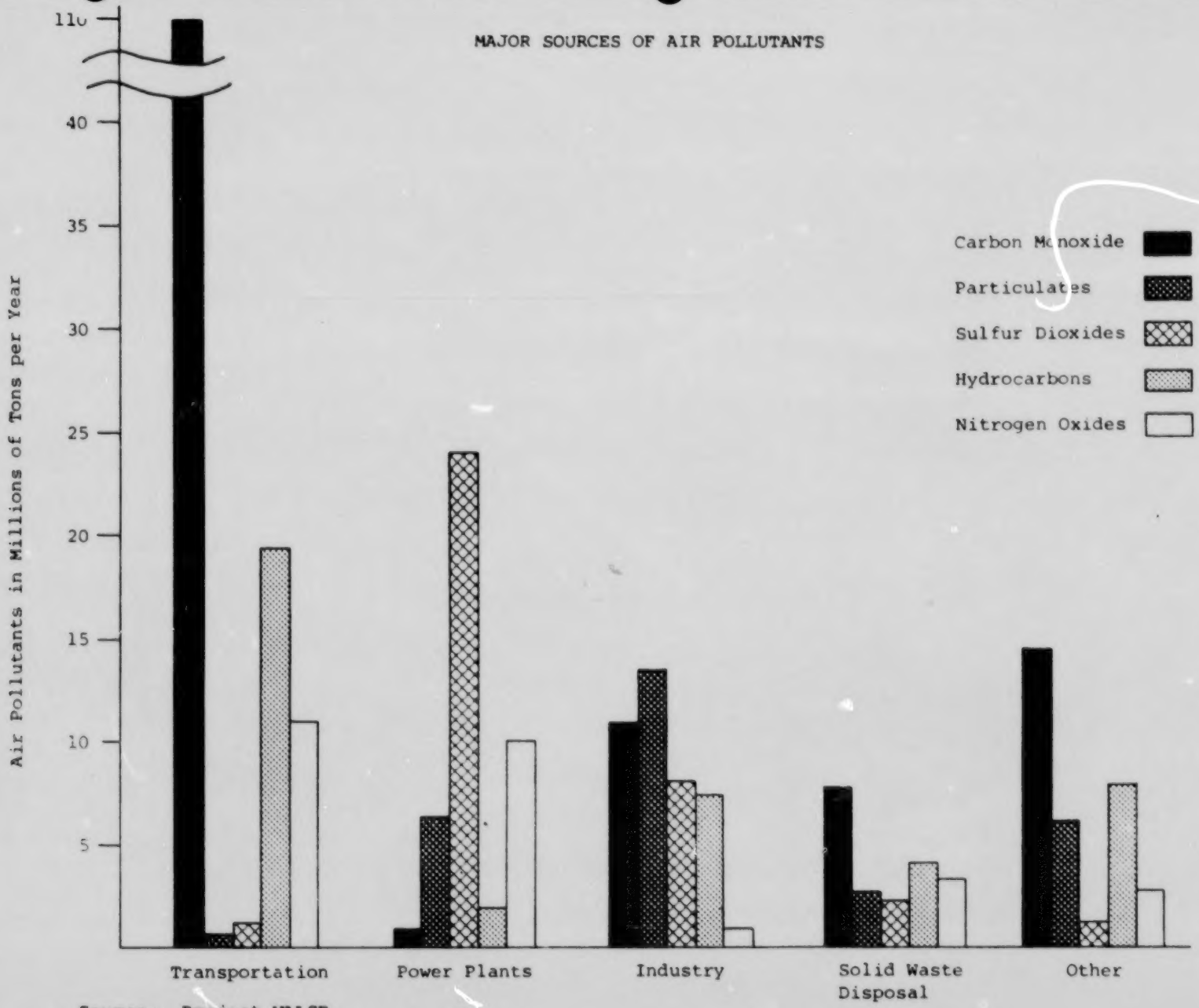
3. Therefore, higher population concentrations in the East and in western big cities suffer the most from acid rain.

6. So far, students have been exposed to miscellaneous information about air and water pollution. It has purposely been presented in a random fashion to pique their curiosity and encourage participation. Now that their appetites have been whetted, the background essay, "Air and Water: What Do They Have to Do with Health?" can help fill them in on the

bigger picture. You may wish to summarize this material and present it in a mini-lecture format or use it as a reading assignment.

7. Let students know that over the next few days they will be gathering information on the quality of air and water in their own community. In the next lesson, you will start to plan that activity with them.

MAJOR SOURCES OF AIR POLLUTANTS



Source: Project WALSE

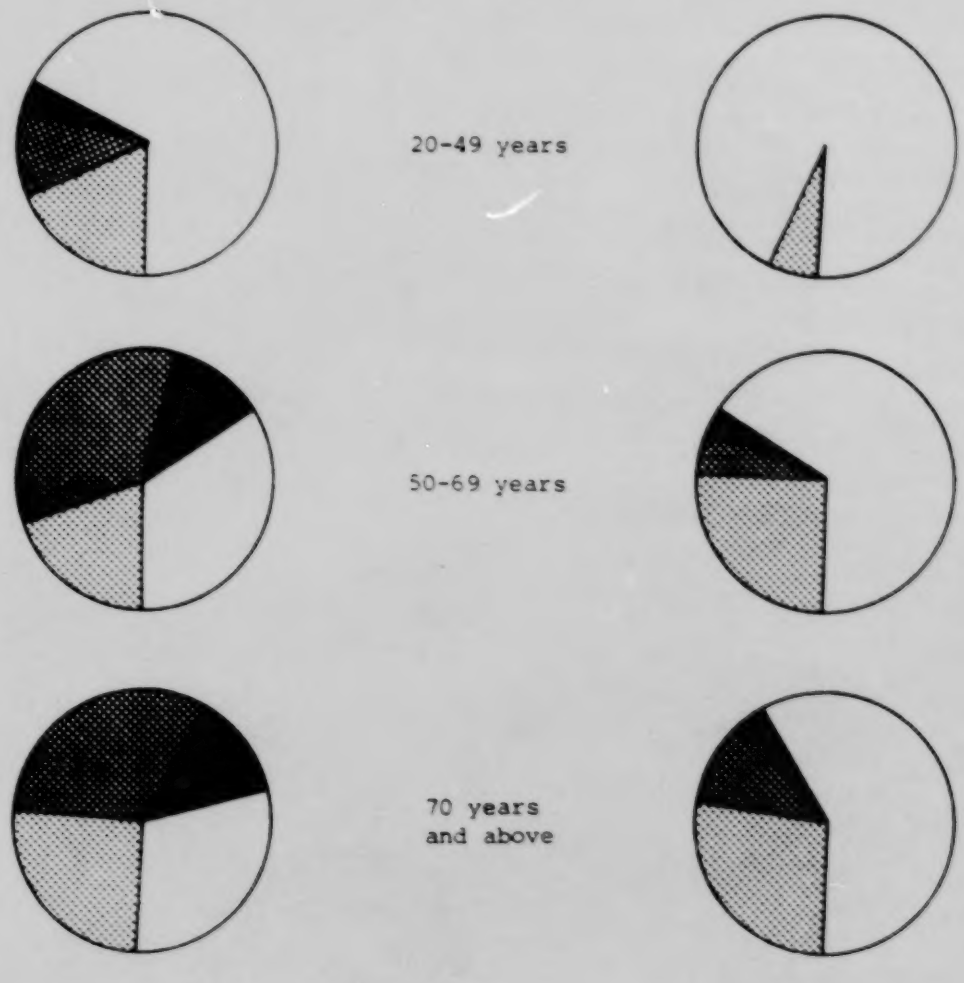
PER CAPITA WATER AVAILABILITY (1971)

Source: The Global 2000 Report to the President of the U.S., prepared by the Council on Environmental Quality and the Department of State, 1980.

PER CAPITA WATER AVAILABILITY (2000)

Source: The Global 2000 Report to the President of the U.S., prepared by the Council on Environmental Quality and the Department of State, 1980.

PREVALENCE OF EMPHYSEMA IN TWO CITIES
WITH CONTRASTING LEVELS OF AIR POLLUTION



Adapted from Rena Corman, Air Pollution Primer (American Lung Association, 1978), p. 73.

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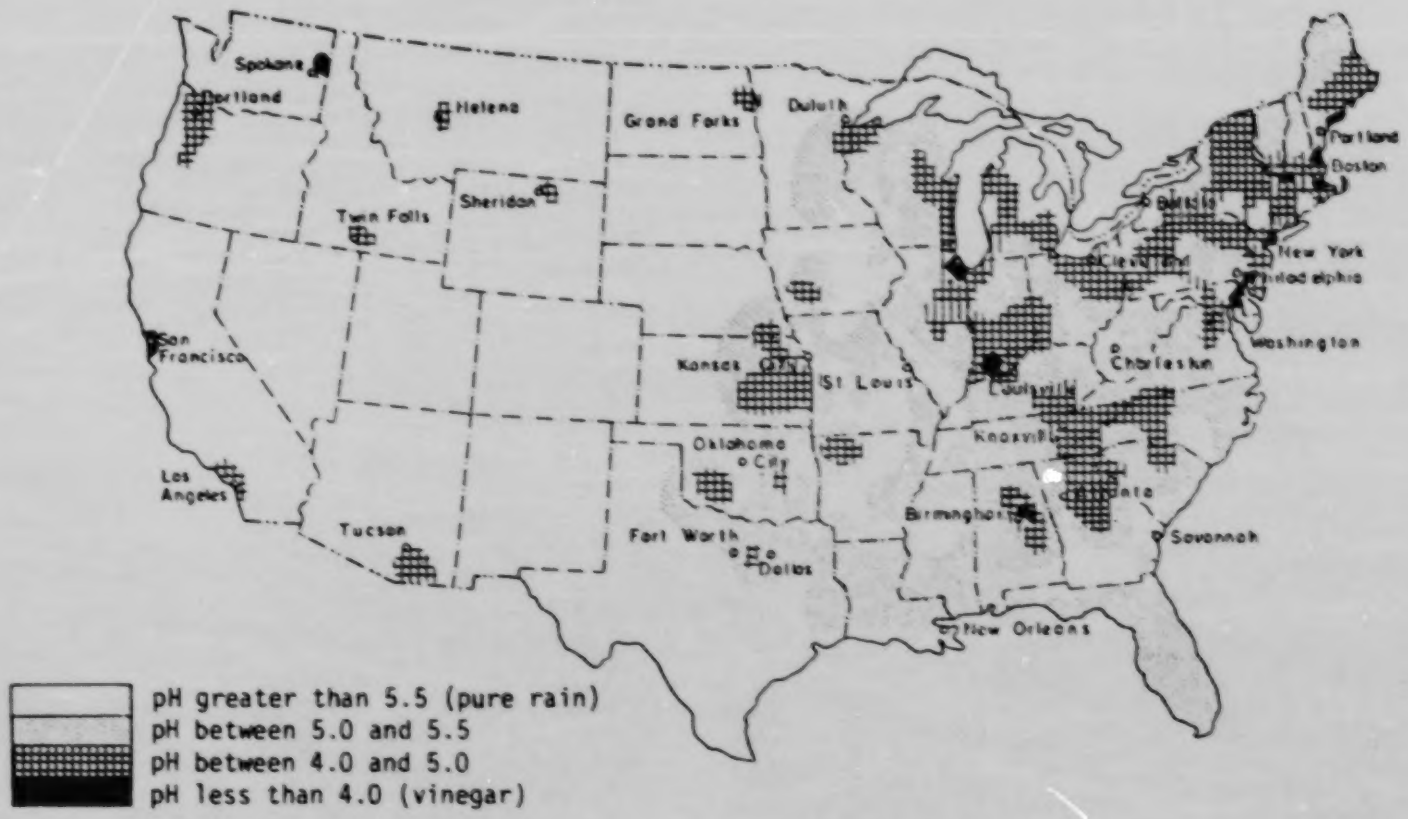
ACID RAIN DISTRIBUTION IN THE UNITED STATES



Source: Acid Rain, EPA, July 1980 (based on nationwide study by thousands of school children in 1973).

AIR AND WATER: WHAT DO THEY HAVE TO DO WITH HEALTH?

Air and water are essential for human survival...we can't live for more than five minutes without air, and permanent brain damage occurs in less time than that. Most human beings cannot survive more than five days without water. On average, most people need to consume five pounds, or two and a half quarts, of water or other liquids each day. The quality of the air we breathe and the water we drink affects our health and well-being in many ways, but we don't often recognize our dependence on clean air and water until something goes wrong.

Air Pollution

The following cases illustrate some of the very dramatic ways in which major air pollution incidents have affected human health:

December 5, 1952--London, England: Four thousand people died in five days due to black smog, a combination of fog and pollutants generated by the burning of high-sulfur coal and other industrial pollutants.

October, 1948--Donora, Pennsylvania: Among a population of 14,000, close to 6,000 became sick. Instead of the expected average of two deaths for the period, the mixture of fog and pollution-laden air was responsible for 20 deaths.

Winter 1963--New York City: During a period of heavy air pollution, Asian flu, and extreme cold, 405 people died because of air pollution alone.

But often the health effects of poor air quality are not so visible nor so immediate. Many of us unknowingly breathe in pollutants every day. This long-term exposure can have serious effects.

For example, a twelve-year survey, ending in 1960, of deaths in and around Nashville, Tennessee, indicated that air pollution may have contributed to deaths from respiratory disease. More deaths from breathing ailments occurred in the sections of the city subjected to the heaviest air pollution.

Investigations in Great Britain, Japan, and the Soviet Union also confirm that common colds and other upper respiratory infections occur more often in areas with high pollution levels than in areas with lower pollution levels.

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Lung cancer cannot be attributed to any single cause, but it seems very likely that air pollution, together with other factors--especially cigarette smoking--contribute to its development. Several studies have shown that in countries where air pollution is greater lung cancer rates are also significantly higher.

Sometimes the health effects of one pollutant are made worse by the presence of another pollutant. For example, asbestos workers who smoke have a far higher risk of cancer than those who do not, and the risk is much more than would be expected by simply adding the risk from smoking to the risk from asbestos.

To sum up, air pollution has been linked to increases in:

--diseases of the respiratory system: bronchitis, asthma, emphysema, pneumonia, lung cancer. The nose, sinuses, throat, bronchial tubes, and lungs all have direct contact with the air we breathe in.

--diseases of heart and blood vessels: some pollutants can pass through the lung membranes into the blood. Air pollution also increases the risk of heart attacks because struggling to breathe causes a strain on the heart.

--cancer: airborne carcinogens (cancer-causing substances) can enter the body through the skin as well as the lungs. They can also be carried by the blood to any organ.

--skin diseases, allergies, eye irritation: effects are more severe for people who already have heart or lung problems and for the very young and very old.

Water Pollution

Traditionally, health problems associated with water pollution have been caused by contamination of drinking water by human wastes. Water contaminated by sewage containing bacteria can cause diarrhea, which is often fatal for infants in developing countries where this is still a problem. Other water-borne diseases include malaria, typhoid, and cholera. Certain parasites can also be transmitted by water. Schistosomiasis, for example, is a very troubling disease, prevalent in many developing countries, which involves water-borne parasites.

More and more, in both developed and developing countries, water pollution problems stem from industrial development and poor land use. Toxic wastes are being dumped directly into streams and rivers or onto the ground where they seep into ground water (water that collects and moves under the surface of the earth). Surprisingly small doses of these chemicals can cause poisonings. Some chemicals have been associated with cancer, birth defects, and miscarriages. Other pollutants attack specific body parts, such as the kidneys or brain, and can have long-term ill effects. Still others, such as excess salt, found in the cold regions of the country where salt is used to melt ice on wintry roads, contribute to an increased risk of heart attacks and strokes. (Salt contributes to high blood pressure, which in turn contributes to heart attacks and strokes.)

As with air pollution, there have been many dramatic and deeply troubling water pollution incidents:

March, 1973--Minamata, Japan: Residents of Minimata won their first major court case against the Chisso Corporation. The company, which had been dumping dangerous mercury wastes into the village's fertile fishing waters, was held responsible for thousands of cases of methyl-mercury poisoning.

Mid-1970s, early 1980s--Hall County, Nebraska: Excessive amounts of nitrogen fertilizers used in the corn fields of the Nebraska farming region increased the level of nitrates in the water. Infants whose formulas were made with this water suffered from severe anemia.

Spring 1976--Love Canal, Niagara Falls, New York: A chemical dumping ground buried since the 1940s erupted, spewing its poisons into the homes and backyards in a residential neighborhood built on top of the old dump. Residents reportedly suffered unusually high numbers of miscarriages, birth defects, and other physical problems.

As troubling as these incidents are, many experts are equally concerned about the slow and invisible effects long-term exposure to low levels of pollutants may have on human health. In some cases, we know that low levels of pollutants are dangerous and that their presence in our water supply should not exceed minimum standards. But for many other substances our knowledge is incomplete.

Activity Two

Community Environmental Profile: The Plan

Objectives

Cognitive: Students will be able to:

- Describe the importance of clean air and water to their health.
- Identify some of the major environmental pollutants and their health effects.
- Recognize the effect of land-based activities in the community on air and water quality.

Affective: Students will:

- Value having clean air and water for their personal consumption and for that of their fellow citizens.

Skills: Students will gain in ability to:

- Identify sources of required information.
- Conduct an interview of public officials and/or other community resource people.

Activity at a Glance

Using fact sheets for background, students interview people in local government agencies and community organizations to gather information about their environment and its health qualities. Working in groups, they will organize their data and present what they have learned to the rest of the class in Activity Four.

Preparation

1. Duplicate Fact Sheets on Community Resources, Air Quality, and Water Quality in sufficient quantities for each student to have one fact sheet.

2. Duplicate questionnaires so that each member of a group has a copy of that group's questionnaire.

Procedure

Review: By filling in the Community Environmental Profile Questionnaires students will gain insight into the environmental health of their local community and identify particular problem areas. They will collect data on the community's environmental characteristics and identify agencies responsible for maintaining air and water quality. The first step, done in this lesson, is for students to understand the task and plan how to get the information. The second step, done as homework, is to gather data. The third step, done in small groups in Activity Four, is to organize the data and present it to the rest of the class.

1. Start the activity by describing the purpose of the Community Environmental Profile and the use of the questionnaires. The first questionnaire, on Community Resources, deals with how a community uses its natural resources and asks students to look for information on population, land use, solid waste disposal, and community health. The second, on Air Quality, focuses on discovering sources of air pollution in the local community and identifying agencies responsible for monitoring air quality. The third, on Water Quality, investigates where the water supply comes from, how it is treated, and whether there are any water pollution or supply problems in the community.

2. Divide the class into three groups. Ask all the people who are working on water to sit together, all working on air to sit together, and so on. Distribute the fact sheets and questionnaires to each group. Ask the groups to read their questions and refer to the fact sheet for additional information that may help them understand the importance of the questions they will investigate. Point out that key words and phrases they may not know have been underlined on the questionnaire. Definitions for these words appear at the end of their fact sheets. Explain that because there is so much information to gather, each person will be responsible

for one or two questions from one of the three areas. (The questions vary in complexity. You may want to assign them to students accordingly, or you may have students select their own question within the group.)

3. Allow students three to five days to obtain the information. Remind them that many of the agencies they will want to contact are open only during the business day. Some suggestions to help students in their fact-finding mission follow in procedure #5.

4. In preparation for Activity Four, two or three students should obtain or construct a large map of the community. Three feet by five feet would be a usable size; larger would be better.

5. Suggestions to Help Students in Their Fact-finding Mission

- Encourage students to review the local newspaper to see what issues have recently been of concern in the community.

- Have students ask parents or family friends if they are aware of any current environmental issues in the community.

- Call your City or Town Hall and ask them for the name and telephone number of a person in each agency or department in your community or county who would have responsibility for the areas to be investigated. Ask in advance for the cooperation of one person from each office--someone who would be willing to answer student inquiries. Post the list of agencies, names and phone numbers on the class bulletin board. Here is a list of agencies usually part of local government and their area of responsibility.

Title	Purpose
Conservation Commission	Has responsibility for general environmental concerns--monitoring of wetlands and conservation areas.
Department of Health	Deals with public health issues, including sanitation, epidemics, enforcing health laws, and usually is responsible for air quality issues.

Highway Department	Builds and maintains streets and sidewalks.
Park Department	Builds and maintains parks for public use; often is combined with recreation department.
Department of Planning	Establishes land use policy, reviews and monitors planned developments, plans for future growth.
Department of Public Works	Maintains public buildings and property, which in some cases may include highways, water and sewers, trees and parks.
Recreation Department	Plans and operates public recreation programs.
Water Department	Maintains and monitors water supply and waste water systems; plans for future needs.
Zoning Board (Board of Appeals)	Assesses plans for conformity with existing regulations.
Town Clerk	Maintains town records, such as population data.
Town Council (Legal Department)	Represents interests of the town in any legal dispute.

- If you cannot identify local resources, ask your regional EPA office or laboratory for help. The regional offices and laboratories are:

Regional Offices

EPA Region 1: JFK Federal Building, Boston, MA 02203 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont) 617-223-7210

EPA Region 2: 26 Federal Plaza, New York, NY 10007 (New Jersey, New York, Puerto Rico, Virgin Islands) 212-264-2525

EPA Region 3: Sixth and Walnut Streets, Philadelphia, PA 19106 (Delaware, Maryland, Pennsylvania, Virginia, West Virginia, District of Columbia) 215-597-9814

EPA Region 4: 345 Courtland Street NE, Atlanta, GA 30308
(Alabama, Georgia, Florida, Mississippi, North Carolina, South Carolina, Tennessee, Kentucky) 404-881-4727

EPA Region 5: 230 South Dearborn, Chicago, IL 60604
(Illinois, Indiana, Ohio, Michigan, Wisconsin, Minnesota) 312-353-2000

EPA Region 6: 1201 Elm Street, Dallas, TX 75270
(Arkansas, Louisiana, Oklahoma, Texas, New Mexico) 214-767-2600

EPA Region 7: 324 East 11th Street, Kansas City, MO 64106
(Iowa, Kansas, Missouri, Nebraska) 816-374-5493

EPA Region 8: 1860 Lincoln Street, Denver, CO 80295
(Colorado, Utah, Wyoming, Montana, North Dakota, South Dakota) 303-837-3895

EPA Region 9: 215 Fremont Street, San Francisco, CA 94105
(Arizona, California, Nevada, Hawaii, Guam, American Samoa, Trust Territories of the Pacific) 415-556-2320

EPA Region 10: 1200 Sixth Avenue, Seattle, WA 98101
(Alaska, Idaho, Oregon, Washington) 206-442-1220

Laboratories

Environmental Monitoring and Support Laboratory
Cincinnati, OH 45268, 513-684-7301

Environmental Monitoring Systems Laboratory
P.O. Box 15027
Las Vegas, NV 89114, 702-736-2969

Environmental Monitoring Systems Laboratory
Research Triangle Park, NC 27711, 919-541-2106

Environmental Research Laboratory
College Station Road, Athens, GA 30605,
404-546-3134

Environmental Research Laboratory
200 SW 35th Street, Corvallis, OR 97330,
503-757-4601

Environmental Research Laboratory
6201 Congdon Boulevard, Duluth, MN 55804,
218-727-6692

Environmental Research Laboratory
Sabine Island, Gulf Breeze, FL 32561,
904-932-5311

Environmental Research Laboratory
South Ferry Road, Narragansett, RI 02882,
401-789-1071

Environmental Sciences Research Laboratory
Research Triangle Park, NC 27711, 919-541-2191

Health Effects Research Laboratory
Cincinnati, OH 45268, 513-684-7401

Health Effects Research Laboratory
Research Triangle Park, NC 27711, 919-541-2281

Industrial Environmental Research Laboratory
Cincinnati, OH 45268, 513-684-4402

Industrial Environmental Research Laboratory
Research Triangle Park, NC 27711, 919-541-2821

Municipal Environmental Research Laboratory
Cincinnati, OH 45268, 513-684-7951

Robert S. Kerr Environmental Research Laboratory
P.O. Box 1198 (South Craddock & Kerr Lab. Road)
Ada, OK 74820, 405-332-8800

- Contact the local office of any of the following groups:

  American Lung Association

  Sierra Club

  Audubon Society

  County Extension Service

  Enlist someone who would be willing and able to answer student inquiries. Post their name and phone number.

- If students need additional contacts, have them call the local newspaper and ask for the names of other voluntary organizations in the community interested in environmental issues.

- Ask students if any of their parents are involved, either professionally or on a volunteer basis, with environmental work. If so, invite a willing parent to come to class or to be interviewed over the phone.

Variation

As an alternative to first-hand research, assemble a panel of experts to come to class and be interviewed. Guests should be selected to represent both expertise in several areas and differing points of view in the community. Provide them with copies of the Community Environmental Profile questionnaires and fact sheets in advance so they will know what background the students have and what questions will be asked. Prepare the class so that students are ready to get answers for their Community Profile questions, and also to ask about concerns of special interest to themselves.

COMMUNITY ENVIRONMENTAL PROFILE

Community Resources Questionnaire

1. Is the size and shape of your community changing?

What was the population 20 years ago? _____ Today _____

What do planners expect it to be in 20 years? _____

How many square miles are there in the community? _____

How many people per square mile (population density)? _____

Was the community always this size and shape? _____

_____

Will it be more crowded in 20 years? _____

If so, what problems will that cause? _____

_____

_____

2. How is land used in your community?

How much land is developed? How many acres (or square miles) are in the following uses?

Commercial _____ Residential _____ Industrial _____

How much land is used for public purposes (schools, fire stations, hospitals, etc.)?

_____

How much land is open space? How many acres (or square miles) are in the following uses?

Farm land _____ Wetlands _____ Bodies of Water _____

Woodlands _____ Parks _____

Are there pollution problems associated with these land uses? If so, describe:

_____

_____

3. Are there industrial or power plants that could generate air or water quality problems?

Do any industries use heavy metals in their work? _____

Do they use hazardous organic compounds? _____ If so, what ones?

_____ _____

Are there radioactive materials in use? _____

Are there microwave installations nearby? _____

What precautions are taken to protect the community? _____

_____

_____

_____

_____

Do you think they are adequate? _____ Why or why not? _____

_____

_____

_____

_____

4. Are there many farms, stockyards, nurseries, or other large outdoor industries in the area?

Are aerial pesticides used? _____ Chemical fertilizers? _____

Are other treatments used that could cause air pollution or runoff problems?

_____

What precautions are taken to protect the community? _____

_____

_____

_____

_____

4. (continued)

Do you think they are adequate? _____ Why or why not? _____

_____

_____

_____

_____

5. How does your community dispose of its solid wastes?

How many tons of trash and garbage does your community produce each day?

_____ Each week? _____

How does the community dispose of the waste? Is it disposed of locally or shipped to another area?

_____

How much does it cost the community to dispose of its wastes?

_____

Are there any ground water or surface water pollution problems from dumps or landfills? If so, please describe?

_____

_____

_____

_____

List any polluted water areas.

_____ _____

_____ _____

_____ _____

Are there any air pollution problems from incinerators? If so, describe.

_____

_____

_____

_____

5. (continued)

Is there a recycling center in the community? _____ Where? _____

_____ What is done with materials collected? _____

_____

_____

_____

7. How healthy are the people in your community?

What is the death rate per 1000 population from respiratory diseases, heart and circulation diseases, and cancer today?

_____

What was it 20 years ago? _____

_____

COMMUNITY ENVIRONMENTAL PROFILE

Air Quality Questionnaire

1. Where is the nearest Environmental Protection Agency air monitoring station?

_____

What information does it gather? _____

_____

What does it show about air quality trends in your area in recent years?

_____

_____

_____

_____

2. What agencies or departments are responsible for monitoring air quality in your community?

List local, county, state, and regional agencies and their particular concerns.

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

3. Has your community ever had a hazardous air alert? _____

What pollutants were present? _____

_____

Where did they come from? _____

_____

3. (continued)

How did it affect the community health? Describe any incidents:

_____

_____

_____

What was done to prevent repeated incidents? _____

_____

_____

_____

4. Who burns coal or oil in or near your community?

Check with fuel companies and develop a list of kinds of users.

_____

_____

_____

Do industrial users use pollution control devices in their smokestacks?

_____

_____

Do home furnaces cause significant air pollution? _____

_____

Does this affect community health? _____ If so, how? _____

_____

_____

5. Is there a nuclear power plant located in or within 50 miles of your community?

If so, have there been any radiation alerts in the area? _____

_____ Give the details of any alert: _____

_____

5. (continued)

Has any group or individual opposed its location there? _____

If so, what happened? _____

_____

_____

_____

6. Does polluted air from other regions travel through your community?

If so, where from? _____

What pollutants are carried through? _____

_____

How might this affect local health? _____

_____

_____

_____

_____

7. Do many cars, buses, trucks travel in or through your community?

How many miles of roads are there in your city or town? _____

How many cars and trucks are registered in the community? _____

_____

What is the ratio of cars to people? _____

What percentage of people have to use a car to get to work or for other necessary trips?

_____

_____

Are there any major highways going through the community? _____

7. (continued)

Are there regular traffic jams in certain areas? _____ If so, what is the cause?

_____

_____

How do these conditions affect air quality and health? _____

_____

_____

_____

Are there regulations or community plans to reduce the effects of air pollution from automobiles?

_____

_____

_____

8. Where does electric power for your community come from?

Ask the local utility company where the power is produced. _____

_____

What energy sources are used to generate it? _____

_____

What health effects are associated with the process? _____

_____

_____

Are pollution control devices used by the power company? _____

_____

9. Are open burning and/or incinerators allowed in your community?

Is there a ban on open burning of trash? _____ Is it enforced? _____

Is there an incinerator in use? _____ Does it burn efficiently? _____

Are open fires for cookouts permitted? _____

COMMUNITY ENVIRONMENTAL PROFILE

Water Quality Questionnaire

1. What agencies or departments are responsible for maintaining water quality in your community?

List local, county, state, and regional agencies and their particular concerns.

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

2. Where does your local water supply come from?

Try to get a water supply map to show your classmates the source(s) of their water supply and the route it takes to reach them. If you cannot get a map, describe the source(s) and how the water reaches the community:

_____

_____

_____

_____

What agency or department is responsible for delivering the water supply?

_____

_____

_____

3. Is the water treated before it is piped to people's homes?

How is the local water treated? _____

_____

_____

_____

4. What happens to the waste water from your community?

Is it treated before it is returned to the water cycle? _____

Describe any treatment and its purpose: _____

_____

_____

_____

_____

Do other communities use the water discarded by your community? _____

5. Have there been problems with polluted water supplies in your community in recent years?

If there have been any problems, describe them. What kind of pollution was present, and what was its source? What was done about the problem?

_____

_____

_____

_____

6. Have there been water shortages in your community in recent years?

If so, what caused the short supply? _____

_____

_____

How did it affect the community? _____

_____

_____

What is being done to prevent future shortages? _____

_____

_____

_____

7. How is water used in your community?

How many gallons per day for residential use? _____

How many gallons per day for commercial use? _____

How many gallons per day for industrial use? _____

How many gallons per day for agricultural use? _____

Do any of these users dump waste water or let it run off directly into ponds or streams?

_____

Do they treat water before dumping? _____

8. Where can you go to have your drinking water tested?

List name and telephone number of one or more places.

_____ _____

_____ _____

_____ _____

What will the basic test cover? _____

_____

How much will it cost? _____

What other tests are available, for instance, for various chemical contaminants?

_____

_____

_____

How much do they cost? _____

_____

FACT SHEET ON COMMUNITY RESOURCES

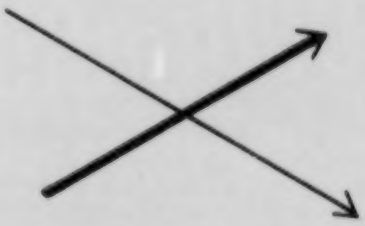
As populations increase and industry grows in an area, heavier demands are made on the natural resources in the environment. Here are some examples of how it works:

More people creates more demand for water, space and services, such as schools, hospitals, stores, trash removal.

More demand for space and services leads to greater land use. Land that once was used for farms and forests is used for buildings. Wetlands get paved over, diminishing the land's ability to store water. More landfills and dumps are needed for trash and garbage.

Greater land use diminishes the ability of the land to store water. It also results in fewer recreational areas, more traffic, and greater possibilities for air and water pollution.

A graph of the situation would look like this:



The bold arrow stands for population and industry. The thin arrow stands for availability of clean air and water, and open land. As population and industry grow, they place greater demands on the natural system and therefore decrease the availability of clean air and water, and open land.

Glossary

Ground water: Water that collects in natural underground storage areas.

Hazardous organic compounds: Chemicals that can cause illness or injury to living things or to the environment; organic chemicals usually contain carbon and are made from petroleum.

Incinerator: A structure for burning wastes from homes, businesses, and industry.

Landfills: Dumps where wastes are covered every day with 12 inches of dirt.

Microwave installations: Equipment that uses a particular kind of radiant energy, the microwave.

Radioactive materials: Substances that give off radiation.

Runoff: Water from any source traveling across the surface of the land and draining into natural waterways or sewers.

Recycling center: A place where used bottles, cans, papers, and other waste products are collected for reuse.

Surface water: Water that is visible on the surface of the land, in lakes and streams.

FACT SHEET ON AIR QUALITY

The major sources of air pollution in this country are:

Motor vehicles: The greatest amount of air pollution comes from motor vehicles, which contribute a variety of poisonous fumes through their exhaust systems.

Factories and power-generating plants: These plants burn coal or oil, both of which contribute sulfur and nitrogen gases and carbon particles through their smokestacks. Pollution control devices, such as scrubbers, exist to reduce these emissions. Communities must decide if it is worth the extra cost to protect their health by insisting that these devices be installed.

Residential and commercial users: Burning coal, oil, wood, or natural gas in heating systems contributes the same poisonous mix of fumes through chimneys and exhaust vents.

Burning of refuse in open dumps and incinerators: Burning of this kind puts heavy amounts of particles and various poisonous gases into the air.

These major sources of air contamination put 200 million tons of pollutants into the nation's air each year, including:

- Sulfur oxides, primarily from smokestacks and chimneys.
- Carbon monoxide, nitrogen oxides, and hydrocarbons, primarily from auto exhaust.
- Photochemical oxidants and ozone, from the action of sunshine on the hydrocarbons emitted by motor vehicles.
- Particulate matter, such as dust and dirt, smoke, tiny bits of metals, and radioactive particles.
- Acid rain from chemical changes in the sulfur and nitrogen oxides as they are carried in the air.

Pollutants are mixed together in the air and can be carried hundreds and thousands of miles by wind currents. If a pollutant is present in hazardous amounts, almost certainly other pollutants will be present, too.

It takes only a very small amount of a pollutant in the air to be damaging to people and other forms of life. We breathe an average of 16 times per minute, and inhale thousands of particles with each breath. A person in a comparatively clean suburb or small town would inhale about 40,000 particles with each breath. In a city the same person would inhale at least 70,000 particles with each breath.

Glossary

Hazardous air alert: A government warning to the general population that air quality is low and apt to damage their health.

Incinerator: A structure for burning wastes from homes, businesses, and industries.

Particulates: Tiny bits of solid or liquid matter suspended in the air.

Pollution control devices: Equipment designed to reduce or eliminate pollution before it reaches the open air.

Scrubbers: Devices that use a liquid spray to remove pollutants from an air stream; for example, they remove sulfur gases from smokestacks.

FACT SHEET ON WATER QUALITY

Water Uses

The average person drinks at least 2 1/2 quarts of water or other liquids a day. In addition to the water we drink, the average American uses about 60 gallons of water per day at home, a figure that could be much reduced through conservation measures. In addition, the average community uses about 150 gallons per person per day. Here are some of the major uses of water (per person, per day):

- Residential: drinking, cooking, laundry, flushing toilets, bathing, watering gardens: 60 gallons
- Industrial: average area: 50 gallons
  highly industrialized area: up to 400 gallons
- Public uses: fire fighting, swimming pools, water for public buildings and recreation areas: 10 gallons
- Commercial: cooking, cleaning, drinking: 20 gallons
- Loss: leaks and breaks in underground pipes: 1 gallon

Water Sources

The sources of all of our water supplies are rivers, lakes, and underground water storage. As we use water from these sources, they are refilled by rainfall. Water moves constantly in a cycle from clouds to earth and back again. The water we use today is the same recycled water Cleopatra floated on in the ancient Nile. The earth only has a fixed amount of water. We cannot create any more, so we must take good care of what we have.

Major Sources of Water Pollution

Direct dumping of chemical pollutants by industries and homeowners: Environmental Protection Agency regulations require that industry remove toxic substances from waste water before it is returned to the water cycle, but these regulations are not always enforced. Homeowners also contribute when they dump pesticides, chemical solvents, or grease and oil into sewers or directly on the ground. Pollutants can get into our water supply from direct dumping into lakes, rivers, and streams and also from dumping on land, because the pollutants seep into the ground water.

Too many septic tanks too close together: When communities build too many houses too close together, the ground becomes clogged with sewage and cannot be cleansed naturally. (Sewage pollution can also occur when heavy rains cause sewer systems to overflow, sending raw sewage into lakes and rivers.)

Insufficient sewage treatment: In areas where homes are tied into a main sewer system, waste water eventually arrives at a sewage treatment plant. Modern sewage treatment plants successfully remove disease organisms, but most do not have the technology to remove chemical contaminants. There is no method for removing radioactive pollutants.

Highway road salt: In an effort to reduce accidents on icy roads, many communities salt roads to melt the ice. Oversalting has dramatically increased salt levels in local water supplies, which poses a health threat for persons with high blood pressure. (Salt contributes to high blood pressure which in turn contributes to the risk of heart attacks and strokes.)

Overuse of nitrogen-based fertilizers: Farmers are discovering that overuse of nitrogen-based fertilizers can increase the level of nitrates in the ground, which in turn seep into ground water and get carried into lakes, rivers, and streams. Nitrate-contaminated water has serious health effects, especially for infants, and also does considerable environmental damage.

Radioactivity: There is no known method for cleaning up radioactivity from nuclear fallout, power plant failure, or uranium mines.

Glossary

Aquifer: An area of sand and gravel in which water is stored underground.

Ground water: Water that collects in natural underground storage areas.

Run-off: Water from any source traveling across the surface of the land and draining into natural waterways or sewers.

Sewage: Discarded water containing human wastes.

Waste water: Discarded water from any process.

Water cycle: The continuous exchange of water between land and atmosphere.

Activity Three

Air and Water Quality Case Studies: Where People Made a Difference!

Objectives

Cognitive: Students will:

- Recognize that water and air pollution problems are not unique to the United States but exist worldwide.
- Name at least two cases in which polluted water and two cases in which polluted air affected human health.
- Be able to explain how pollution in one place can contaminate other areas, giving examples for both air and water.
- Categorize the major ways in which water and air become polluted.

Affective: Students will:

- Realize that individuals, acting alone or with others, really can make a difference in improving environmental quality and, as a result, the health of many people.
- Recognize the severity of water and air pollution problems, but balance that recognition with a healthy optimism about our ability to improve the situation.

Skills: Students will be able to:

- Read case-study material and then report on what they have learned to the class.
- Draw evaluative inferences from factual information.
- Develop data analysis techniques.

Activity at a Glance

This activity will take two class periods, the first to focus on water pollution, and the second on air pollution. Each period begins with a brief demonstration that explains how air or water pollution arises and can be transmitted to distant places. Students then read case studies of pollution problems that have occurred in the United States and abroad. Many of the cases highlight the contribution a single individual or group of people made to improving the situation.

Preparation

1. Review instructions for the air and water demonstrations. Do not be misled by the lengthy description of the demonstrations. It takes more time to describe how to do something than it takes to do it. Each demonstration takes approximately five minutes to set up and about two minutes to do--a very worthwhile seven minutes. The demonstrations simply and accurately explain information that would otherwise remain vague and obscure, and they have proven to be very effective in capturing student interest.

2. Decide whether you will begin with air or water, and then gather and set up materials for the demonstration.

3. Preview the case studies for the topic you decide to begin with. Both the air and water cases have been selected to represent typical types of problems in different parts of the United States and the world. You may wish to highlight ones that are particularly relevant to your region.

4. Duplicate 15 copies of the "Case Study Data Analysis Sheet."

5. Duplicate "Evaluation Score Sheet," one for every pair of students.

Procedure

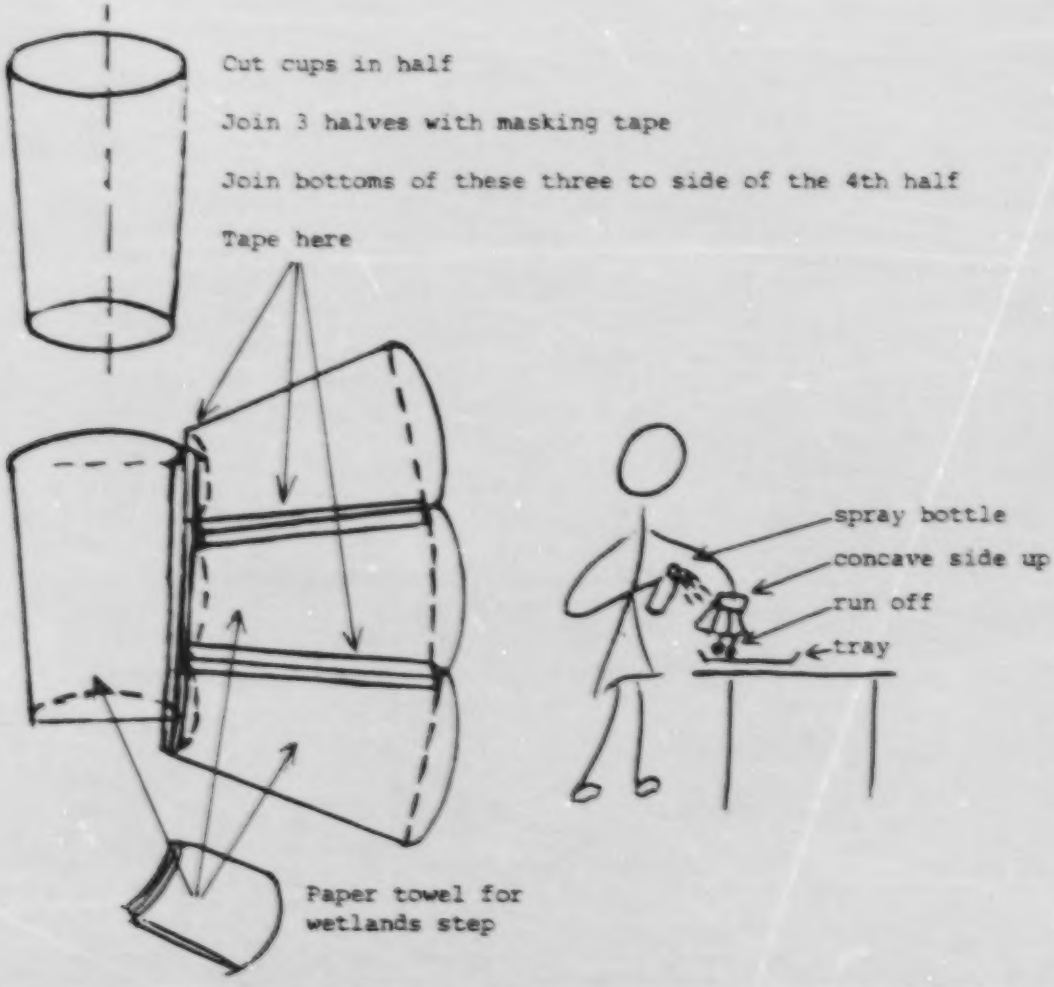
1. Mini-lecture and Demonstration: Watershed Water Cycle and Leaching

WATERSHED WATER CYCLE

You will need to have the following materials on hand:

Spray bottle containing water
Two or three styrofoam cups, cut in half lengthwise
Masking tape
Paper toweling folded to fit into the plastic cup model
Flat pan on which to place the model

Tape the styrofoam pieces together to create a model like this:


Cut cups in half
Join 3 halves with masking tape
Join bottoms of these three to side of the 4th half
Tape here
spray bottle
concave side up
run off
tray
Paper towel for wetlands step

Here is how one teacher began this lesson:

> Today we are going to look at a wide range of water pollution problems. These are real cases that have been documented by scientists and environmental experts. They represent typical kinds of cases here in the United States and in other countries around the world. One reason they have been selected is that in nearly every case, somebody--an individual or a group--became concerned that something might be wrong and decided to do something about it. Individuals often enlisted the help of other people, because environmental problems usually require that people work together to solve them.
>
> Before we look at the cases, I would like to explain a few important things that will help you understand why pollution in one place can move so easily to other, distant places.
>
> All of our water supplies come from just two sources: from surface water, found in lakes, rivers, or man-made reservoirs, or from ground water. The amount and quality of this water depends on how human activities affect it as it moves through the water cycle.
>
> Imagine, if you will, that these styrofoam cups represent local terrain--the hills and valleys in some particular place. (Start squirting the water on the mock terrain.) As rain or snow falls on the earth, it runs down the slopes of mountains, collects in the nooks and crannies of the earth's surface forming lakes and ponds, runs between lower ridges to create rivers and streams, and finally finds its way to the ocean. (As you squirt the "terrain," students will, in fact, see the lakes and ponds, streams and rivers form and all the water eventually find its way to the ocean, represented by the flat pan on which the "terrain" is sitting.) The land area in each basin is called a <u>watershed</u>.
>
> After the rain falls, it is warmed by the heat of the sun, evaporates into the air, collects in the form of clouds, and falls back to the earth again. That is, in essence, what the <u>water cycle</u> is: a continual flow of precipitation, evaporation, and precipitation again. (Actually, it is a little more complicated than that because plants are also giving up moisture to the air in a process called transpiration, and some of the water seeps into the ground and is stored beneath the surface as ground water.)

(Call student attention to the speed at which the water runs across the surface of the "watershed." Nature has provided a control mechanism to keep rain from running too rapidly through a watershed and causing floods. This mechanism is a wetland, a land area that holds a lot of water. To demonstrate this, place folded paper toweling in one or two of the watershed basins and repeat the sprinkling process.) A lot of water is absorbed before any runs out. This is how a wetland slows down the flow of water on the land surface, holding it and releasing it slowly into streams. A wetland also releases water into ground water storage areas, places where water accumulates under the land surface.

Wetlands have been used for dumps for hundreds of years. Only in recent years have the connections between surface waters and ground waters been understood. Ground water moves around and is stored beneath the surface in much the same way that surface water moves in streams and is stored in lakes. Thus, dumping contaminated wastes into wetland areas can lead directly to problems with water supplies taken from either ground or surface waters.

Nature usually can keep itself clean if we do not overload the system or if we do not pollute it with substances that can not easily break down into harmless components. In the last few decades we have been seeing a lot of pollution because we are overloading the system--dumping more wastes than the natural system can handle. Many of today's pollutants are new, synthetic chemicals that never break down or that react with other chemicals to create new dangerous combinations. In some cases, even a very small amount may be hazardous when people are exposed to them for long periods of time.

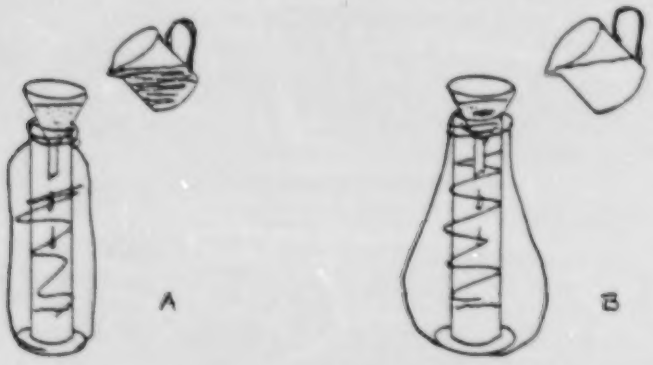
LEACHING

Ground water can be affected by substances in the ground around it. The purpose of this activity is to demonstrate how water can be changed as it flows through sand and gravel and to help explain how pollution travels.

You will need to have the following materials on hand.

Two funnels
Cotton batting or balls (to represent sand)
Small bottle of food coloring
Container of water (a cup is enough)
Two glass jars or similar containers
Some black dirt and/or debris
Two measuring cups or small plastic bowls to use for mixing and pouring

Pack the two funnels with cotton and place them over the glass jars, as shown in the diagram:



Set up Demonstration A. Put a couple of spoonfuls of black soil into a cup or bowl. Add 1/2 cup of water and mix by swishing the cup around. Slowly pour the dirty black water into the funnel of cotton, representing clean sand. Examine residue at the bottom of collecting jar. Have class observe what has happened as water moved through the cotton. This is a filtering process. It demonstrates how sand and gravel can remove suspended materials from dirty water.

Set up Demonstration B. With a finger move some of the cotton in funnel B until you have made a slight depression. Drip about three drops of food coloring into the hole, explaining to the class that this represents toxic wastes such as cleaners we put down the drain, oil spills, or chemicals dumped in landfills.

Slowly pour the rest of the clean water into funnel B. Examine the residue at the bottom of the collecting jar. What has happened as the clean water moved through the contaminated cotton? The chemical went into solution and was carried along in the water. This is how toxic chemicals carelessly dumped can get into our ground water and water supplies. This process of water removing chemicals from the soil is called leaching.

	Poured substance	+	Sand substance		Result after passing through sand
A	dirty water	+	cotton (clean sand)	→	cleaner water
B	clean water	+	contaminated cotton (sand)	→	contaminated water

2. Water Quality Case Studies

Once you have completed the demonstrations on the water cycle and leaching, pass out the water quality case studies. There are eight studies to be shared among students in groups of two, three, or four, depending on class size. In a group as large as three or four, one or two students should volunteer to read the case aloud to the others. After students have familiarized themselves with their cases, point out the study questions at the end of the cases and ask students to discuss these in their small groups.

Pass out the Case Study Data Analysis Sheet. Ask a member of each group to fill in the sheet based on the case the group just read. The sheet is a kind of comprehension check, so members of the group should discuss the answers. Where disagreements exist, the members should explore why they disagree. (In some cases, more than one source and more than one health effect can be checked.)

Before the first case is presented, pass out the Evaluation Score Sheet. Students will need to make copies of the grid on that sheet for each case they evaluate. Be sure they put the name of the case they are scoring beside each grid. The class' job is to evaluate the seriousness of the cases they are about to hear along four dimensions--source of pollution, health effects, environmental effects, and response to the problem received. More complete instructions appear on the Evaluation Score Sheet.

Ask each group to select a spokesperson to report on its case to the rest of the class. The spokesperson should summarize the case, explain what their study questions were and how the group answered them. Encourage the rest of the class to press the reporting group for accuracy and clarity. They will not be able to fill in their evaluation score sheets unless they really understand the problem.

You will not have time for all eight groups to report on their cases unless you decide to extend the activity into another day. Get through only as many cases as the class can comfortably discuss in the time you have.

3. Notes for Mini-lecture

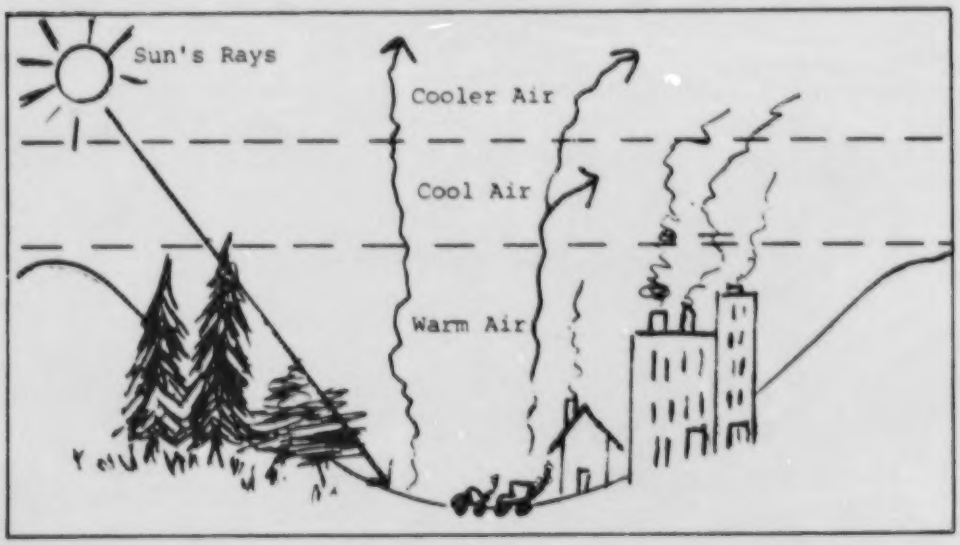
AIR POLLUTION

What happens to make dirty air suddenly so poisonous that people cannot survive in it? For the most part, we do get used to living with the pollutants usually found in our air supply, even if it does harm our health. So how do emergency situations come about?

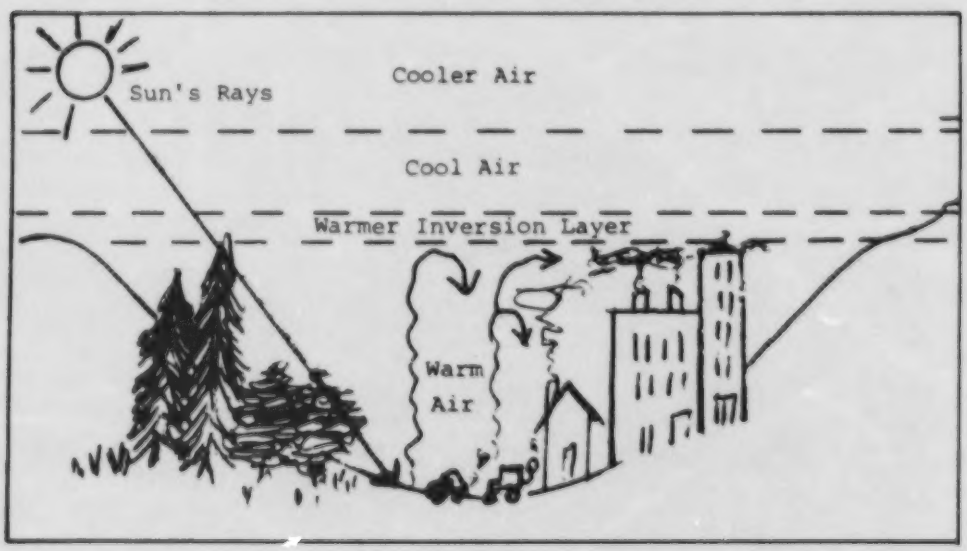
There can be two sources of hazardous air incidents. One is human error or accident, where large amounts of poisonous fumes are suddenly released into the air because of a mechanical failure, explosion, or some other accident. This can result in a quick and painful death for persons caught nearby, and in acute and chronic health problems in persons for miles around. For example, a skin condition called chloracne continues to afflict people in a town in Italy several years after an explosion in a local chemical plant poisoned the air of the entire community and surrounding countryside. This kind of occasional accident is a price we pay for the fruits of technology.

A second kind of hazard occurs when a weather condition called a thermal inversion is present. As a general rule, the higher up you go, the colder it is. It is also true that warm air tends to rise. Usually warm air rises and mixes with the cooler upper layers, carrying a lot of pollution up and away as it does this. Occasionally, weather conditions sweep a mass of warm air in over a layer of cooler, heavier air. This situation is called an inversion. It is extremely stable and can last for several days, especially when the inverted air is trapped in a valley. In this situation, polluted air from ground level rises through the colder air, meets the ceiling of warmer air, but cannot go up through it. The polluted air is trapped, and finds its way back to ground level with its load of poisons. The level of pollution builds and builds until the weather changes. This can happen in any area, but is especially serious when it happens in a city. Some of the air pollution case studies examine what happened in different places around the world when inversions occurred.

Diagrams Showing Effect of Warm Inversion Layer
on Air Currents and Pollution



Warmed Air Moving Freely Upward



Warmed Surface Air Trapped by Warmer Inversion Layer

4. Air Quality Case Studies

Pass out the seven air quality case studies and proceed as you did for the water cases.

Variation

Present the mini-lectures and demonstrations for both air and water together at the start of the first class. Then distribute both air and water studies. This is a good option for large classes because it means more studies are available at one time.

CASE STUDY DATA ANALYSIS SHEET

Fill in the information for each case study that you read by putting a check mark next to the appropriate item or items in each section.

	WATER CASES								AIR CASES						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SOURCE OF POLLUTION															
Water															
Sewage															
Industrial waste															
Consumer habit															
Agricultural waste															
Land use problem															
Air															
Transportation															
Power plants															
Industry															
Residential/ commercial															
Solid waste disposal															
HEALTH EFFECTS															
Short-term threat															
Chronic threat															
Treatable damage															
Permanent damage															
Health threat averted															
ENVIRONMENTAL EFFECTS															
Easily removed hazard															
Long-term hazard															
Permanent hazard															
Localized hazard															
Widespread hazard															
RESPONSE TO PROBLEM															
Citizen action															
Government action															
Polluter action															
Problem eliminated															
Problem under control															
Inadequate action taken															
No action taken															

EVALUATION SCORE SHEET

Now assess each case study on the basis of the information you have recorded on the analysis sheet. To do this, give each case a rating on a scale of 1 to 5 for each of the four information sections.

For section 1, Source of Pollution, consider whether the source was from a single, easily identified polluter as a best case, or a number of hard-to-find sources as a worst case.

For section 2, Health Effects, consider whether a person whose health is affected will probably recover with no lasting effects or whether the damage to health is a chronic threat, permanent, or even fatal.

For section 3, Environmental Effects, consider whether the environment can be rid of the pollutant easily, or whether it will be very difficult or impossible to remove it.

For section 4, Response to Problem, consider whether the action taken was effective and appropriate, or, at worst, if no action was taken.

Best Worst

1 2 3 4 5

	A	B	C	D	E
1. Source of Pollution					
2. Health Effects					
3. Environmental Effects					
4. Response to Problem					
Total Score for Case					

Now, considering all these factors, list the cases in order of least serious to most serious.

_____

_____

_____

Activity Four

Community Environmental Profile: What We Discovered

Objectives

Cognitive: Students will be able to:

- Describe environmental characteristics of their community and the relationship to public health.
- Recognize existing or potential health problems from environmental causes.
- Identify local agencies responsible for care of the local environment.

Affective: Students will:

- Appreciate the environmental strengths and weaknesses of the community where they live.
- Want to become more involved in maintaining a healthy environment.

Skills: Students will gain in ability to:

- Share and organize data.
- Present information effectively.
- Perceive cause-and-effect relationships.

Activity at a Glance

Students complete the community profile begun in Activity Two by presenting their findings to the class and discussing implications for community air and water quality.

Preparation

1. Have large map of the community up on the wall, or spread out on large table or several desk tops.

2. Have available a selection of colored marking pens.

Procedure

1. Have members of the three research groups set up in Activity Two (community resources, air quality, water quality) meet to share their findings and develop a brief report to present to the rest of the class on their topic. Each group can select one or two of its members to present the data orally while other members of the group use colored marking pens to locate on the map facilities, such as power plants, or events, such as traffic jams, that can affect the environment. Statistical data can be noted on the margins of the map. (Color code air and water information for easier identification of problem areas.) Allow about 20 minutes for groups to organize the presentations.

2. Allow each group 10 to 15 minutes for its presentation and for questions from the rest of the class. All members of the group should be prepared to answer questions on its topic.

Locations to be marked on the map include:

Group 1, Community Resources: residential areas, commercial centers, industrial sites, farm areas, bodies of water, parks, dumps, landfills, or incinerators, recycling centers.

Group 2, Air Quality: local utility companies, power plants (including nuclear), major highways, traffic jam sites, arrows showing direction of polluted air coming from other areas.

Group 3, Water Quality: water supply site (or arrow showing direction it comes from), local water works (treatment plant), sewage plant (waste water treatment--include arrow showing where water reenters the water cycle), testing laboratories, polluted waters.

Data that can be entered in the margins:

Group 1, Community Resources: population figures, area of community, land use areas, tons of trash and garbage, death and disease rates.

Group 2, Air Quality: number of days of unhealthy air, number of cars and trucks.

Group 3, Water Quality: number of gallons of water used.

3. When the presentations and the map are completed, examine the environmental characteristics of the community that could affect health. Have the class observe whether residential areas are near sources of pollution and discuss whether they feel that adequate precautions are taken. Have students note the direction and distance from which the water supply and/or air pollutants travel coming in to the community, how far dumps or landfills are from water supply sources, where waste water goes when it leaves the community. Emphasize that community responsibility for the environment and public health extends not only to its own area but also to its neighbors.

4. In a summary discussion emphasize these points:

- Community health depends on adequate air quality and a sufficient supply of clean water. Most modern-day communities have some problems in one or both of these areas.

- Pollution of these resources causes health hazards. It is very difficult to control where pollutants go once they get into the natural cycles.

- Pollution gets into the air from all kinds of smokestacks and exhaust systems, including those of homes and cars. The worst air polluter is the automobile.

- Pollution gets into the water from what is dumped on the land as well as what comes out of pipes. What each person drops on the ground or pours down a home drain can add up to water pollution as harmful as industrial wastes.

- Regulations to control air and water pollution are designed to protect our health and to preserve needed natural resources. Regulatory agencies need the support of the general public in order to do their job well.

Activity Five

From Knowledge to Action

Objectives

Cognitive: Students will be able to:

- List water and air quality conservation measures they as individuals can take.
- Describe actions a concerned citizen might undertake to bring about improved community conditions.

Affective: Students will:

- Express willingness to adopt environmentally healthful habits.
- Show increased interest in community health issues.

Skills: Students will gain in ability to:

- Analyze information for its usefulness to others.

Activity at a Glance

Students identify conservation measures they can incorporate into their personal lives and plan messages they would like to publish or promote in their local community.

Preparation

1. Duplicate "What Would You Do?" Checklist, one for each student.

2. Optional: Duplicate pages of conservation tips ("Air Quality at Home," "Water Quality at Home," "Pesticide Safety Tips," "Keeping Your Car in Shape").

Procedure

1. The following pages have information on things individuals can do to help maintain environmental quality. There are tips on water, air, pesticides, and car maintenance, all actions that an individual can take.

Begin the lesson with brief remarks on the role of the individual in maintaining a healthy environment. Some of the most serious pollution problems are the result of accumulated individual actions. Air pollution from transportation sources is a perfect example. Every car and truck is driven by one person and usually owned by one person who is responsible for its care and maintenance. It is an individual decision to get a checkup for the car, drive in the most efficient and least polluting way, leave the car home in favor of walking or biking. Individuals use pesticides, put toxic materials down kitchen sink drains, carelessly dispose of trash. These same individuals can change their habits and have a positive instead of negative effect on their environment.

2. Use the reference sheets on water, air, pesticides and car care to provide students with examples of individual action they can take.

3. Now that the class knows so much more about pollution problems and their origins, are they willing to act on that knowledge? Distribute copies of "What Would You Do?" checklist. Explain the continuum from Never to Always. Students respond by personal choice, with no right or wrong answers. Each individual will have reasons why it is easier to make one commitment than another. Practically nobody would do all of the listed things all of the time.

4. Allow a few minutes for students to complete the page. They can share their commitment by a show of hands on who would never, who would sometimes, who would always do a particular action. Doers may want to try to persuade non-doers to take action by giving reasons why they feel an action is important.

5. Point out that when pollution problems or resource shortages become severe enough, community programs encourage, and sometimes require, pollution control or conservation measures. Students will have some knowledge of problems in their own community from Activities Two and Four, and whether there are programs to control them. Ask them how the class can provide support to a program it feels is most helpful, or

how the class can help to start a needed program where none exists. Remind them that knowledge must precede effective action. Thus, a first step might be a community education activity--posters, a flyer or newsletter on a pollution problem, picture essays of polluted areas to be published in the local press, assistance on a campaign for environmental improvement such as a bottle bill--there are many possibilities. Time will be the main constrain in choosing one and carrying it out.

Whatever students decide to do, have it covered by the local press if possible. This rewards their effort and at the same time increases distribution of knowledge on the topic.

WHAT WOULD YOU DO?

	Never	Sometimes	Always
1. Use public transportation instead of a car.	____	____	____
2. Join a car pool--drive only when you must.	____	____	____
3. Ride a bicycle or walk when practical.	____	____	____
4. Use as little packaging material as possible.	____	____	____
5. Reuse old packaging materials.	____	____	____
6. Put litter into proper containers.	____	____	____
7. Recycle bottles, papers, cans.	____	____	____
8. Stop smoking.	____	____	____
9. Smoke only outdoors.	____	____	____
10. Use cleaning fluids and other solvents only with doors or windows open.	____	____	____
11. Stop using pesticides.	____	____	____
12. Take shorter showers.	____	____	____
13. Keep bottle of drinking water in refrigerator.	____	____	____
14. Recycle household water for watering gardens and lawns.	____	____	____
15. Check household faucets and toilets for leaks.	____	____	____

AIR QUALITY AT HOME

Don't put poisons into your own air! You have nothing else to breathe.

- Keep furnaces and appliances clean and in good working order to reduce polluting emissions.
- Be sure there is adequate ventilation (fresh air) whenever a fuel is being burned for heating or cooking. An airtight house may reduce energy costs, but it may do it at the expense of indoor air purity.
- A "No Smoking" rule improves the health of everyone in the household, not just that of the smoker. If a family member really wants to continue to smoke, reduce harm to other people by limiting smoking to one room, or, better yet, outdoors, and by having an air filter system to remove smoke particles as quickly as possible.
- Be sure there is adequate ventilation whenever a volatile chemical is in use for cleaning, pest control, painting, solvent purposes, or any indoor use.
- If chemical pest controls must be used, follow directions precisely, avoid getting chemical substances on skin or clothing, limit the spray to infested areas, and do not leave opened containers to evaporate into the air.

WATER QUALITY AT HOME

Here are some things each person can do to help maintain a good water supply.

Personal Use

Take shorter showers; five minutes is ample time to get clean.

Use less water in the bathtub. Close the drain before turning on the water; use just a couple of inches of water.

Use less water brushing teeth and shaving. Have the water running only when it is needed, not during the whole process.

Keep a bottle of drinking water in the refrigerator. This saves running water to get it cold.

Household Use

Run dishwashers and washing machines only with full loads.

Recycle water from washing machine and bathtub--this is perfectly good for washing floors and woodwork. Use a clean rinse water afterwards.

Use garbage disposal sparingly; put your garbage in a compost pile instead.

Use the minimum of detergents: presoak laundry; scrape dishes before washing; use cold water detergent for washing clothes.

Repair leaky faucets and pipes immediately.

Outdoor Use

Water only the plants, not the concrete--soak the garden lawn slowly to get most water to the plants and reduce run-off; don't water when the sun is hot, to reduce evaporation.

Use good car maintenance practices: wash car with as little water as possible and in a place where run-off will go to lawn or shrubbery, not down the street; don't pour old oil or grease on the ground or down the drain.

PESTICIDE SAFETY TIPS

- Always read the label before buying or using pesticides. Use pesticides only for the purposes listed and in the manner directed.
- Do not apply more than the specified amount of pesticide. Overdoses can harm you and the environment.
- Keep pesticides away from food and dishes.
- Keep children and pets away from pesticides and sprayed areas.
- Do not smoke while spraying.
- Avoid inhalation of pesticides.
- Never spray outdoors on a windy day.
- Pesticides that require special protective clothing or equipment should be used only by trained, experienced applicators.
- If you mix pesticides, do it carefully to avoid splashing.
- Avoid breaks or spills of pesticide containers.
- If you spill a pesticide on your skin or on your clothing, wash with soap and water and change your clothing immediately.
- Store pesticides under lock in the original containers with proper labels. Never transfer a pesticide to a container, such as a soft drink bottle that would attract children.
- Dispose of empty containers safely. Wrap single containers of home-use products in several layers of newspaper, tie securely and place in in a covered trash can. Never burn boxes or sacks. In case of farm or ranch use, single containers may be buried where water supplies will not be contaminated. Dispose of large quantities in special incinerators or special landfills.
- Wash with soap and water after using pesticides, and launder your clothes before wearing them again.
- If someone swallows a pesticide, check the label for first air treatment. Call or go to the doctor or the hospital immediately and take the pesticide label with you.

Source: U.S. Environmental Protection Agency

KEEPING YOUR CAR IN SHAPE

Your car is part of an urgent health problem, air pollution, which can make you sick. A well maintained car pollutes less than a poorly maintained car. It pays to keep your car in shape.

- At least once a year have your car exhaust system checked. The emission check is quick, and it can save money and health.

  If your car is smoking, it may mean:

  Worn piston rings
  Incorrect carburetor adjustment
  Carburetor malfunction

  If an exhaust analyzer shows high carbon monoxide:

  Dirty air filter
  Clogged PCV system
  Partially closed choke
  Incorrect carburetor adjustment
  Poorly adjusted timing
  Malfunctioning thermostatic air control

  If the analyzer shows high hydrocarbons:

  Fouled spark plugs
  Faulty spark plug wires or distributor cap
  Ignition points improperly set
  Ignition timing incorrect
  Incorrect carburetor adjustment
  Vacuum leak

- Maintain your engine properly. Tuning the car for emissions can save fuel and reduce dangerous pollutants. It also helps the engine last longer.

- Support legislation to promote healthy air. Some states have enacted inspection/maintenance programs that require cars to pass a regular emission inspection and to be adjusted if carbon monoxide and hydrocarbons exceed the limits set for the car's model and year.

- Use public transportation or join a car pool to further reduce auto emissions in your area.

Sources: American Lung Association
U.S. Environmental Protection Agency

Other Programs and Resource Materials

A wide variety of information materials, curriculum guides, activity descriptions, model programs, and resource listings are available from many different organizations at the National, State, and local level.

Organizations proceeded with an asterisk (*) on the following lists are but some of these having resources pertinent to this module.

SOME NATIONAL HEALTH ORGANIZATIONS

The following list is a sampling of national organizations offering health information. It is not intended to be exhaustive, and will hopefully be updated periodically to identify organizations that have been missed or that have produced new resources useful in health education curricula. THOSE SEEKING PUBLICATIONS OR INFORMATION ASSISTANCE FROM THESE ORGANIZATIONS SHOULD ALWAYS DETERMINE IF THERE IS A LOCAL OR STATE AFFILIATE OF THE NATION ORGANIZATION AND CONTACT THE CLOSEST OFFICE FIRST. Addresses and phone numbers can be checked through telephone directories, libraries, and local health agencies. ALSO HEALTH INFORMATION AND HELP IN IDENTIFYING OTHER VALUABLE RESOURCES CAN FREQUENTLY BE OBTAINED FROM OFFICIAL STATE AND LOCAL HEALTH AND EDUCATION AGENCIES, COLLEGE AND UNIVERSITY HEALTH EDUCATION PERSONNEL, AND/OR LIBRARY REFERENCE GUIDES. Many of the publications and services are free to the public; others involve a nominal charge.

Action on Smoking and Health
2013 H St., N. W.
Washington, D.C. 20006

Al-Anon Family Group Headquarters, Inc.
P. O. Box 182
Madison Square Station
New York, NY 10059-0182

Alcoholics Anonymous
P. O. Box 459
Grand Central Station
New York, NY 10163

American Academy of Dermatology
820 Davis
Evanston, IL 60201

American Alliance for Health, Physical Education, Recreation and Dance
Association for the Advancement of Health Education
1900 Association Drive
Reston, VA 22091

American Cancer Society
777 Third Avenue
New York, NY 10017

American Council on Marijuana and Other Psychoactive Drugs
6193 Executive Boulevard
Rockville, MD 20852

American Dental Association
Bureau of Health Education and Audiovisual Services
211 E. Chicago Avenue
Chicago, IL 60611

American Diabetes Association
Two Park Avenue
New York, NY 10016

American Dietetic Association
430 N. Michigan Avenue
Chicago, IL 60611

American Hearing Society (formerly National Association for Hearing and Speech Action)
10801 Rockville Pike
Rockville, MD 20852

American Heart Association
7320 Greenville Avenue
Dallas, TX 75231

American Hospital Association
Department of Order Processing
840 N. Lake Shore Drive
Chicago, IL 60611

* American Lung Association
1740 Broadway
New York, NY 10019

American Medical Association
Department of Health Education
535 N. Dearborn Street
Chicago, IL 60610

American Medical Association Auxiliary
535 N. Dearborn Street
Chicago, IL 60610

American Optometric Association
Attn: Communications Division
243 N. Lindberg Boulevard
St. Louis, MO 63141

American Osteopathic Association
Public Relations Department
212 E. Ohio Street
Chicago, IL 60611

American Pharmaceutical Association
2215 Constitution Avenue, N.W.
Washington, DC 20037

American Podiatry Association
Council On Education
20 Chevy Chase Circle, N.W.
Washington, DC 20015

American Red Cross
17th and E Streets, N.W.
Washington, DC 20006

American School Health Association
P.O. Box 708
Kent, Ohio 44240

American Social Health Association
260 Sheridan Avenue
Palo Alto, CA 94306

Arthritis Foundation
1314 Spring Street
Atlanta, GA 30309

Association for Retarded Citizens
(formerly National Association for Retarded Children)
P.O. Box 6109
Arlington, TX 76011

Asthma and Allergy Foundation of America
1302 18th Street, N.W., Suite 303
Washington, DC 20036

Blue Cross/Blue Shield Association
676 N. Saint Clair Street
Chicago, IL 60611

Cystic Fibrosis Foundation
Suite 558
3384 Peachtree Road, N.E.
Atlanta, GA 30326

Epilepsy Foundation of America
4351 Garden City Drive
Suite 406
Landover, MD 20785

Family Service Association of America
44 E. 23rd Street
New York, NY 10010

Group Against Smoker's Pollution
P.O. Box 632
College Park, MD 20740

Kimberly-Clarke
Life Cycle Center
2100 Winchester Road
Neenah, WI 54956

Leukemia Society of America
800 Second Avenue
New York, NY 10017

March of Dimes, Birth Defects Foundation
1275 Mamaroneck Avenue
White Plains, NY 10605

Mental Health Materials Center
30 E. 29th Street
New York, NY 10016

Metropolitan Life Insurance Co.
Health and Safety Education Div.
One Madison Avenue
New York, NY 10010

Muscular Dystrophy Association
810 Seventh Avenue
New York, NY 10019

National Center for Health Education
30 E. 29th Street
New York, NY 10016

National Council on Alcoholism, Inc.
733 Third Avenue, Suite 1405
New York, NY 10017

National Cystic Fibrosis Research Foundation
60 E. 42nd Street, Suite 1563
New York, NY 10017

National Dairy Council
6300 N. Rier Road
Rosemont, IL 60018

National Easter Seal Society
2023 W. Ogden Avenue
Chicago, IL 60612

National Fire Protection
Association
Battery March Park
Quincy, MA 02269

National Genetic Foundation
555 W. 57th Street
New York, NY 10019

National Hemophilia Foundation
19 W. 34th S., Suite 1204
New York, NY 10001

National Kidney Foundation
Two Park Avenue
New York, NY 10016

National Mental Health Association
1800 N. Kent Street
2nd Floor
Arlington, VA 22209

National Multiple Sclerosis
Society
20 E. 42nd Street
New York, NY 10017

National Safety Council
444 N. Michigan Avenue
Chicago, IL 60611

National Society for the Prevention
of Blindness, Inc.
79 Madison Avenue
New York, NY 10016

National Tay-Sachs and Allied
Diseases Association, Inc.
92 Washington Avenue
Cedarhurst, NY 11516

Planned Parenthood Federation
of America, Inc.
810 Seventh Avenue
New York, NY 10019

Public Affairs Committee, Inc.
381 Park Avenue South
New York, NY 10016

Tampax, Incorporated
Department HI
P.O. Box 7001
Lake Success, NY 11402

United Cerebral Palsy Association
330 E. 34th Street
New York, NY 10001

United Parkinson's Foundation
220 S. State St., Room 1809
Chicago, IL 60604

FEDERAL GOVERNMENT RESOURCES

Arthritis Information Clearinghouse
1700 N. Moore Street
Arlington, VA 22209

Cancer Information Clearinghouse
National Cancer Institute
Office of Cancer Communications
Building 31, Room 10A18
9000 Rockville Pike
Bethesda, MD 20205

Center for Health Promotion
and Education
Division of Health Education
Centers for Disease Control
Atlanta, GA 30333

Clearinghouse on the Handicapped
330 C Street, S.W.
Washington, DC 20201

Consumer Information Center
Pueblo, CO 81009

Environmental Protection Agency
Public Inquiries Center, PM 211-B
401 "M" Street, S.W.
Washington, DC 20460

Food and Drug Administration
Office of Consumer Inquiries (HFE-88)
5600 Fishers Lane
Rockville, MD 20857

Food and Nutrition Information
Center (FNIC)
3101 Park Center Drive
Alexandria, VA 22302

High Blood Pressure Information
Center
120/80 National Institutes of
Health, Box UR
Bethesda, MD 20205

National Center for Education in
Maternal and Child Health
3520 Prospect Street, N.W.
Washington, DC 20007

National Clearinghouse for
Alcohol Information
P.O. Box 2345
Rockville, MD 20857

National Clearinghouse for
Drug Abuse Information
5600 Fishers Lane, Room 10A43
Rockville, MD 20857

National Clearinghouse for Family
Planning Information
P.O. Box 2225
Rockville, MD 20857

National Clearinghouse for
Mental Health Information
Public Inquiries Section
5600 Fishers Lane, Room 15C17
Rockville, MD 20857

National Diabetes Information
Clearinghouse
Box NDIC
Bethesda, MD 20205

National Digestive Diseases Education
and Information Clearinghouse
1555 Wilson Blvd., Suite 600
Rosslyn, VA 22209

National Health Information
Clearinghouse (NHIC)
P.O. Box 1133
Washington, DC 20013-1133

National Highway Traffic Safety
Administration (NHTSA)
U.S. Department of Transportation
400 7th Street, S.W.
Washington, D.C. 20590

National Injury Information
Clearinghouse
5401 Westbard Avenue, Room 615
Washington, DC 20207

National Institute for Drug Abuses
5600 Fishers Lane
Rockville, MD 20857

National Institutes of Health
Bethesda, MD 20205

National Heart, Lung, and Blood Institute
Public Information and Reports Branch
Building 31, Room 4A21
National Institutes of Health
Bethesda, MD 20205

Office of Consumer Affairs
Washington, DC 20201

Office on Smoking and Health
Technical Information Center
Park Building, Room 116
5600 Fishers Lane
Rockville, MD 20857

President's Council on Physical Fitness and Sports
450 Fifth Street, N.W.
Suite 7103
Washington, DC 20001

*Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

U.S. Consumer Product Safety Commission
Washington, DC 20207

U. S. Department of Agriculture
Washington, D.C 20250

U. S. Department of Health and Human Services
Washington, DC 20201

Supplemental List - Acting To Create A Healthy Environment

Hubbard
Biological Sciences Curriculum Study
Northbrook, Illinois

Education Development Center, Inc.
55 Chapel Street
Newton, Massachusetts 02160

Hubbard
Health Activities Project
Northbrook, Illinois

Consumers Union Foundation
256 Washington Street
Mt. Vernon, New York 10550

National Science Teachers Association
Washington, D.C.

Channing L. Bete Co., Inc.
Greenfield, Massachusetts

Sierra Club
San Francisco, California

The League of Women Voters
1730 M Street, N.W.
10th Floor
Washington, D.C. 20036

U.S. Department of Education
National Institute of Education
Educational Resources Information Center
Washington, D.C. 20202

CASE STUDY #1: WATER QUALITY

The Case of the Superior Polluters

THE PROBLEM

In 1947, the Reserve Mining Company built a new taconite processing plant in Silver Bay, Minnesota, 55 miles northeast of Duluth. Taconite contains about 25 percent iron. The necessary permits were easy to obtain. People were told that dumping the finely ground tailings into the lake would cause no problems, because they would sink 600 feet to the bottom. This was definitely a cheap solution to the waste disposal problem for the new plant.

However, the dumping did become a significant problem. In 1973, the Justice Department determined that the Reserve Mining discharge contained 35 chemicals, including arsenic, beryllium, cadmium, cobalt, copper, lead, mercury, nickel, selenium, and thallium. All of these metals were carried in suspension in the lake. Also in 1973, the EPA announced that there was a high concentration of asbestos fibers in the drinking water supply for Duluth and at least eight other lake shore communities. This too was probably from the taconite wastes being discharged at Silver Bay. By this time a delta of the pulverized tailings extended about 275 acres into the lake, an area about equal to 50 city blocks.

HEALTH EFFECTS

Substance	Health Effect
Arsenic	Long-term exposure: fatigue, loss of energy; high dosage: poisoning.
Beryllium	Interferes with enzyme system and the functions of the vital organs.
Cadmium	Hypertension and related heart ailments.
Cobalt	High dosage: enlarged thyroid. Traces essential for red blood cell and other tissue maintenance; activates enzymes.

HEALTH EFFECTS (cont.)

Substance	Health Effect
Copper	High dosage: toxic. Trace mineral in all body tissues: essential in formation of hemoglobin and absorption of iron.
Lead	Highly toxic trace mineral: kidney damage, abdominal colic, dysfunction of brain and spinal cord.
Mercury	Acute poisoning in large doses, or slow poisoning over time: more toxic in fish than in water because of higher concentration.
Nickel	Trace mineral found in large amount in human body: function unknown.
Selenium	Occurs naturally in soils and food plants. Indications that too much is toxic: research in progress.

The metals listed above include some that are essential to human health in trace amounts. Even these can be toxic if too much is taken in too short a time.

Asbestos fibers	Asbestosis in the lungs; lung cancer; cancer of the esophagus, stomach, intestines and rectum. Once asbestos fibers enter the body, they remain there indefinitely and can migrate to almost any organ or other part of the body, including the brain. There is no known "safe threshold" of exposure.

ACTION TAKEN

What happened in the years between 1947, when Reserve Mining Company began dumping, and 1971, when the situation caught the attention of government agencies in Washington? For one thing, it became obvious that the taconite tailings did not sink to the bottom and do no harm. The use of Lake Superior as a convenient free dump by one industry was having a noticeable effect on its clear waters in spite of the size of the lake.

By 1955, there were about 75,000 tons of taconite going into Lake Superior every day. That is roughly equivalent to 50,000 junk cars.

Verna Mize first learned of this situation in 1967. She was originally from the Lake Superior area, and she was outraged. She started a one-woman campaign to save the lake. This is how things went:

1969: Verna Mize petitioned government for redress of grievances, with 5,182 signatures collected in 10 days.

May 1971: EPA served notice on Reserve Mining Company. Nothing happened.

February 1972: The Department of Justice filed suit in Minnesota District Court to stop discharge into lake, joined by Michigan and Wisconsin.

August 1973: The trial finally started. Reserve's $46.2 million payroll was at stake. The question of whether company would comply with a court order or shut down was left hanging.

April 20, 1974: Judge Miles Lord closed plant at Silver Bay.

April 21, 1974: Reserve Mining Company appealed to the Eighth District Court in St. Louis.

April 22, 1974: The Silver Bay plant reopened; Reserve Mining Company was ordered to develop a land disposal plan and report back to Judge Miles in 70 days.

August 1974: Reserve reluctantly agreed to a 28-square mile-land disposal site.

June 1976: The project was underway, with a target completion date of April 1980. From 1968 to 1974 Reserve Mining spent $6 million battling this case, by its own admission in court. During that time Verna Mize wrote 8,000 letters, spent over 7,000 hours campaigning, made many trips from her home in Maryland to Lake Superior Country at her own expense, solicited over 25,000 signatures on petitions, visited congressmen and other officials repeatedly, gave scores of interviews, picketed, testified, and most of all persisted, because she believed that Lake Superior was being killed and she could not be an accessory by failing to defend it.

RESULTS

Reserve mining built a $370 million pollution control plant and stayed in Silver Bay.

Discharge into Lake Superior by Reserve Mining Company was stopped.

EPA and the state of Minnesota helped Duluth build a drinking water treatment plant to take the asbestos fibers out of the drinking water.

STUDY QUESTIONS

1. List some of the environmental arguments and the economic arguments that emerged in this case.

2. What three factors in Verna Mize's action over the years were most important to the eventual success of the "Save Lake Superior Campaign?"

3. On the basis of this case, do you feel that existing government regulations and pollution standards are too hard on industry? Give arguments to support your answer.

REFERENCES

Asbestos. EPA Toxic Information Series, April 1980.

"Asbestos Fibers in Duluth Drinking Water Supply," Environmental Facts. Washington, D.C.: EPA, July 1973.

Fanning, Odum. Man and His Environment: Citizen Action. New York: Harper and Row, 1975.

"Is Your Drinking Water Safe?" EPA bulletin, March 1977.

Kirschmann, John D. Nutrition Almanac. New York: McGraw Hill, 1975.

"No One Loses at Silver Bay." Boston Globe, 1979.

"Protecting People and the Environment from Dangerous Chemicals," Toxic Substances Control Act, EPA bulletin, July 1980.

Temple, Truman. "Protecting Lake Superior," EPA Journal, Industry and the EPA, Janaury 1978.

CASE STUDY #2: WATER QUALITY

The Ammonoosuc River

THE PROBLEM

The average vacationer would not suspect pollution problems to come from a favorite resort hotel. But sewage problems can originate wherever there are people. The Mount Washington Hotel, near the base of Mount Washington in New Hampshire, is an elegant old resort built around 1900. The Ammonoosuc River flows right by on its way across New Hampshire to the Connecticut River. Unfortunately, the hotel's sewage treatment system was also built at the turn of the century. It consisted of a large septic tank, and a chlorinator that did not always work. The overflow from the tank was piped to the Ammonoosuc River and discharged with only very sketchy treatment. During summer months, about 14 miles of the river were polluted as a result of the hotel's discharge.

HEALTH EFFECTS

Any water-borne diseases could be present:

Salmonella
Dysentery
Infectious hepatitis
Diarrhea
Typhoid
Cholera

Water is unsafe for drinking, swimming, or fishing.

ACTION TAKEN

The situation was unchecked until the summer of 1970, when a college student working in the area alerted the New Hampshire Water Supply and Pollution Control Commission. He wrote and told them:

> I am not an expert on sewage disposal systems, but I am sure something is wrong here. Sewage is pouring into the Ammonoosuc River from a four-inch pipe coming from the hotel's treatment plant. The smell is bad, and in at least

> one spot below the hotel solid sewage waste has accumulated. The treatment facilities look outdated, but it would take someone who knows something about this to determine if this is so.

The letter resulted in an investigation. There was a very high bacteria count in the water of the Ammonoosuc River below the discharge area. The commission sent a Cease and Desist Order to the hotel. This meant that the hotel management was under official order to eliminate the problem. Attempts to upgrade the treatment system over the next few years were not successful, because the plant was just too old. Finally, the Water Supply and Pollution Control Commission and the hotel management decided on a new land treatment system that would end discharge to the river completely. The new system involved a series of aerated ponds (lagoons) to hold and partially treat the hotel's wastes. This treated sewage would then be used for spray irrigation of woods near the hotel golf course. The system was completed and in operation by September 1978. One alert student deserved a big thank you for his part in correcting a bad situation.

RESULTS

The water quality of the Ammonoosuc River improved rapidly.

The river now meets federal and state standards for fishable and swimmable waters.

STUDY QUESTIONS

1. Why do you think the hotel management let the situation go on for so long?

2. Why didn't the state intervene sooner?

3. How important is a small problem in a remote place like this, compared with some of the major pollution problems we face? Give reasons for your answer.

REFERENCES

"Clean Water For Us All." EPA Bulletin, September 1979.

CASE STUDY #3: WATER QUALITY

The Minamata Tragedy

THE PROBLEM

The Chisso Corporation, located right on the harbor in Minamata, Japan, makes petrochemicals and plastics. The Japanese government tolerated its practice of dumping dangerous mercury wastes into the village's fertile fishing grounds for decades. As long ago as 1925 Chisso had to make indemnity payments to fishermen for damage to the fishing grounds, but the dumping of mercury wastes was not stopped. But for years the people of Minamata were not aware of the health hazards of eating their catch.

In the 1950s the medical profession became interested in outbreaks of a peculiar illness in Minamata. In 1956 the group of symptoms was designated "Minamata disease." Its cause, the Chisso Corporation wastes, was proven by 1959. Medical science continued its investigation of Minamata disease. By 1961, 105 people had been verified as victims, but little was done to assist them. It took the Japanese government until 1968 to find Chisso guilty of causing Minamata disease.

HEALTH EFFECTS

Early symptoms:

- Excessive saliva in the mouth
- Inflamed stomach
- Diarrhea
- Neurological problems such as tremors, irritability, dizziness, moodiness, depression

Progressing to:

- Loss of coordination
- Loss of intellectual ability
- Loss of sight and hearing

Eventual result:

- Destruction of central nervous system
- Death

ACTION TAKEN

In 1971 Life magazine photographer W. Eugene Smith and his wife Aileen decided to document the Minamata story. The whole world was educated about one of its worst cases of industrial pollution, which resulted in the devastation of a Japanese fishing village. The negligency of the Japanese government in tolerating Chisso's long-term dumping of poisonous wastes into a fishing ground was exposed as well. Their book, Minamata, was a compelling photo-essay that vividly portrayed the horrors of methyl mercury poisoning. It sparked action, and served as a warning to the rest of the industrial world.

As more people learned about Minamata disease, citizen groups were formed and took action. Minamata patients won their first major court case in March 1973. The Japanese government appointed a board of doctors and public health officials to review cases and verify them for free treatment. By late 1980 more than 2,403 cases of Minamata disease were verified. Cleanup operations in Minamata Bay were the center of another long dispute between Chisso and the Japanese government. They finally agreed to share the cost of dredging and purifying the bay. Work was started in mid-1980.

In the last five years many more victims of Minamata disease have come forward. At least 5,000 have applied for verification. Politics has come into the verification process. Chisso is in deep financial trouble, but the company has not been declared bankrupt. The government especially wants Chisso to survive, so that Minamata victims do not turn to the government for aid. Scores of applicants for verification have been rejected in recent years. Many borderline cases have been left in limbo indefinitely.

PARALLEL PROBLEMS

Mercury waste problems can be found in many other places. Outbreaks of Minamata disease occurred in Niigata and other places in Japan. The Dryden Paper Company discharged mercury wastes into the English Wabigoon River in Ontario, Canada. The Canadian government brought action to stop the dumping, but the river will be unhealthy for a long time. Ten years later, numerous lawsuits await trial and no victims have been compensated.

In the United States, Woodridge, New Jersey, town officials discovered that levels of mercury in the ground near Berry Creek were among the highest in the world. The officials knew about the Minamata tragedy, and they were worried it could happen in New Jersey. The problem was complicated by the danger of the mercury getting into the creek and washing out into Newark Bay. Between 400,000 and 800,000 pounds of mercury had been dumped on the site. It could be recovered by excavating the contaminated land and processing it. But it has been reported that at least one mercury dealer refused to do this on the grounds that it would depress the market. As of January 1981 no solution to Woodridge's problem had been found.

RESULTS

Victims of Minamata disease continue to come forward.

Chisso no longer discharges methyl mercury into Minamata Bay.

Over $80 million in compensation has been paid through 1980.

Minamata Bay cleanup is in progress, and eventually will cost more than $9 million.

STUDY QUESTIONS

1. Identify two or more decisions that were based on economic priorities.

2. What environmentally sound options were available?

3. What more responsible action could either the government or Chisso have taken in this case in 1925? 1959? 1968?

4. In the long run, is it economically sound practice to dispose of wastes in the easiest and cheapest way? Explain your answer.

REFERENCES

Fine, John C. "Toxic Waste Dangers." Water Spectrum, Winter 1980-81.

Kirshmann, John D. Nutrition Almanac. New York: McGraw Hill, 1973.

Parker, Marcia. "Minamata Revisited." Boston Globe, November 27, 1980.

CASE STUDY #4: WATER QUALITY

Nebraska Nitrates

THE PROBLEM

Infants and young farm animals cannot safely drink the water in Hall County, Nebraska, because of an alarming increase in the amount of nitrates in the ground water in the past few years. This is an area of intensive corn production. Yields of 200 bushels per acre depend on heavy yearly applications of nitrogen fertilizers and on furrow irrigation. This means that water is pumped to the surface from wells and run down furrows between the rows of corn. The plants absorb some of the water, and the rest leaches back down into the ground water. It carries dissolved nitrates from the fertilizer with it. These, in turn, can convert to nitrites, which are hazardous to human health.

The farmland is fairly flat, with deep loam covering about 40 feet of sand and gravel. Rainfall is sparse, so this big aquifer is very important to farmers. They tap into it for their home and barn water supply as well as for irrigation.

HEALTH EFFECTS

Nitrate-contaminated water should not be used to make formula. It should never be given to babies under three months of age. It is not as serious a threat to older children, whose bodies can replace damaged hemoglobin more easily. Boiling the water does not help in this case. Because boiling decreases water volume, the nitrate levels increase.

Can cause "blue" baby in children under three months of age, an anemic condition due to nitrites reacting with hemoglobin.

Lowers resistance of small infants to infectious disease; interferes with proper development.

Affects young farm animals in a similar manner.

ACTION TAKEN

Farm families were having a lot of difficulties. Farmers contacted the University of Nebraska extension service and the U.S. Department of Agriculture offices for help. Fourteen federal, state, and local agencies went to work with area farmers to solve the problem. The university and the U.S. Geological Survey found nitrate concentrations in the Hall County ground water three to four times higher than the allowable standard.

Having seen the harm that nitrate in the drinking water could do, the farmers were eager to cooperate. Ground water protection measures were developed and put into practice. This involved figuring out how much nitrate the corn plants could get from the irrigation water, and reducing the amount of fertilizer used accordingly. As plants take up the nitrates from the irrigation water, the concentration in the ground water is decreasing. This has been carefully monitored on thousands of acres, showing that crop yields remain high with less fertilizer. Farmers have also learned to schedule irrigation more carefully, and to take advantage of conservation measures such as leveling of the land. Meanwhile, they are buying bottled water for drinking and cooking. Some farmers are even buying it for their baby pigs.

RESULTS

Some 41,350 acres of Nebraska cornfields are involved in a ground water reclamation project.

Results are continuously monitored and documented for as long as it takes to restore the ground water.

Nebraska farmers and government scientists discovered that plants can withdraw excess nitrogen from overloaded soils. This could be useful in other places, but would only work in areas of plentiful water.

STUDY QUESTIONS

1. What made this particular pollutant difficult to control?

2. Do you think the farmers would have used large amounts of nitrogen fertilizers to increase their crop yields if they knew that the water supply contamination would result? Why or why not?

3. To get current information on how well the project is working, write to the Nebraska Cooperative Extension Service at the University of Nebraska. Ask about the Agricultural Conservation Program Special Water Quality Project.

REFERENCES

Baker, Earl R. "Nebraska Nitrates," Groundwater Protection: A Water Quality Management Report. Washington, D.C.: EPA, November 1980.

"Is Your Drinking Water Safe?" EPA Bulletin, March 1977.

CASE STUDY #5: WATER QUALITY

Can Brazil Conquer Schistosomiasis?

THE PROBLEM

Four million poverty-stricken peasants in northern Brazil are afflicted with schistosomiasis. This is a deadly disease transmitted by water snails. The ponds and streams that the peasants use for a water supply is home to these snails.

A parasite known as the liver fluke causes schistosomiasis. There are two stages to its life cycle: one in the human body, and one in the snail. Without toilet facilities or even outhouses, peasants relieve themselves at the edge of ponds or streams. Their excrement contains the parasite or its eggs, which rain washes into the snail-infested water. Young flukes lodge in the snail and grow to maturity. When peasants use the water for drinking or bathing, the flukes bore through their skin and make their way into the large blood vessels and then to the liver, spleen, and intestines.

HEALTH EFFECTS

Swelling of liver and spleen, interfering with proper function.

Irritated bladder and intestines.

Bloody urine.

Diarrhea.

Anemia.

Progressive weakness and death.

ACTION TAKEN

Treatment can be successful in early cases, but many victims do not come into the hospitals for help until the disease is far advanced. Often this is too late. Dr. Amaury Coutinho, a Brazilian specialist on schistosomiasis, comments on these advanced cases.

> If we use the medicine, we would kill both the parasites and the patient. The dead parasites would just block the liver.

It is very difficult to control this kind of diffuse pollution problem. Water-borne diseases like schistosomiasis are the result of continuous interaction between the millions of disease infested peasants and their polluted water resources. With no other water resources available, the patient who is cured will only catch the disease again. With millions of peasants carrying the parasite, purified lakes and streams quickly become infested again. This is why water-borne diseases are rampant in the poverty-stricken rural areas of Third World countries like Brazil.

Without an effective program for stamping out schistosomiasis, the problem is spreading. Thousands of peasants from northeast Brazil have migrated to the new frontiers of the Amazon region, bringing their disease into an area that was previously free of it. Many more peasants are moving to the large urban centers of Sao Paulo, Salvador, and Recife. There are outbreaks of this rural disease in these rapidly growing cities, where sewage facilities are scarce in the areas where the peasants settle.

Whether the peasants understand the cause of the disease or not, they have no money to invest in sanitary facilities. The Brazilian government has started building simple outhouses for the peasants, but the people will still have to use polluted lakes and streams for bathing, drinking, and laundry. Purification of these water resources would be an enormously costly undertaking, and in the end it might not work. This is a serious dilemma for Brazil and other developing countries.

RESULTS

Medical treatment provides only a temporary cure.

Outhouses provided for peasants are only a small part of the solution to the problem.

The cost of the needed water treatment program is immense.

STUDY QUESTIONS

1. Why is this disease so hard to control?

2. What could happen if this problem continues unchecked in Brazil?

3. What steps could be taken to control the spread of this disease?

4. What steps would have to be taken to wipe it out?

5. How might this problem affect the economic development of Brazil?

REFERENCES

Kandall, Jonathan. "...But Humans Pollute as Well." New York Times, March 13, 1977.

CASE STUDY #6: WATER QUALITY

TCE on the Loose

THE PROBLEM

Al Malischewski and his family live in Bucks County, Pennsylvania. They moved there to have clean air, clean water, and a nice clean environment. But in 1979, they had some puzzling problems. Sometimes after showers they tingled for some time--as if the hot water were still running. Sometimes the fumes from the hot water were so strong they had to keep the bathroom window open while bathing, even when it was frosty outside. They complained to state officials, who found trichloroethylene (TCE) in their well water. The well was declared useless. The water could not be used for drinking, bathing, or cooking. Al now travels a quarter of a mile to buy drinking water.

All kinds of people use solvents that contain TCE, a heavy colorless liquid that smells like chloroform. It is used to degrease metals, to clean septic systems, to dry clean clothing, and as an agent in various dye processes. It is easy to see how it would find its way into waste waters from small businesses and householders as much as from industry. It is only in the last few years that anybody realized TCE could be dangerous. Very small amounts in the water can be a problem. Only two cupsful (one pound) can make 27 million gallons of water unsafe to drink.

HEALTH EFFECTS

Small amounts cause:

- Abnormal fatigue
- Digestive problems

Higher levels cause:

- Kidney and liver disease
- Psychic disturbances
- Convulsions
- Cardiac arrest

Skin contact can cause persistent rashes.

The risk of human cancer is unknown.

ACTION TAKEN

The Malischewski family is not alone in its misery. Wells in 20 towns in Bucks and Montgomery counties had been contaminated with TCE and had to be closed. TCE has also been found in water supplies in Arizona, California, Connecticut, Florida, Massachusetts, Michigan, New Hampshire, New Jersey, and New York.

The National Academy of Sciences is working with EPA to develop standards for TCE limits. But testing for it requires special equipment that most state labs do not have.

Routine water tests rarely measure TCE, so its presence can go undetected for some time. Even when it has been found in the drinking water, finding where it comes from is often impossible. It is not like an industrial pollutant that comes from a single, large discharge area. Small amounts going into the ground water from many sources can create a harmful, or even dangerous, situation. And nobody really knows how to get it out of the ground water.

RESULTS

TCE is turning up in hundreds of wells that supply drinking water.

STUDY QUESTIONS

1. What two things about TCE make it such a difficult water quality problem?

2. How would you react if TCE were found in your drinking water?

3. How can this kind of water pollution be prevented?

REFERENCES

"TCE: The Story of One Groundwater Pollutant." EPA Groundwater Protection Bulletin, A Water Quality Management Report. November 1980.

CASE STUDY #7: WATER QUALITY

Second-Hand Water

THE PROBLEM

By the mid-1950s Santee was San Diego County's fastest growing town. Its water supply came over 300 miles from the Colorado River. A new sewage treatment plant only partially cleaned the water, but it met state standards and was the best treatment possible with existing technologies. The treated sewage was discharged into Sycamore Canyon Creek, a tributary of the San Diego River.

This part of the United States has a very dry climate, with an average rainfall of ten inches. This means that the San Diego River system has no surface water in it for five or six months of the year. Discharge from sewage treatment plants is not diluted and made safer as it flows. The sewage coming through these plants was a mix of human wastes, household wastes including powerful cleaning agents, and some industrial wastes.

Santee and other towns in Southern California had an expensive and very serious sewage disposal problem when the state Water Resource Control Board raised the purity standards for sewage discharge in 1959. They would have to clean their sewage more thoroughly, or they would have to stop the discharge into the dry creeks that fed into the San Diego River.

HEALTH EFFECTS

From untreated human wastes, spread of water-borne diseases:

- Salmonella
- Diarrhea
- Dysentery
- Infectious hepatitis
- Typhoid
- Cholera

From household and industrial chemicals:
- Headaches
- Rashes and sores on the skin
- Liver and kidney disease
- Intestinal disorders

ACTION TAKEN

In 1959, when California announced the new standards for sewage discharge, there were two options available to Santee. One was to improve their sewage treatment enough to meet the new requirements. This would mean adding a tertiary treatment stage to the existing plant. This technology was then not well developed. It was an expensive option for a small town, and it could easily fail.

The second option was offered by the city of San Diego, where there were plans for a new Metropolitan Sewer System. Sewage from the city and from nearby towns would be given primary treatment only, and discharged into the Pacific Ocean. With this option, initial expense would also be high. Santee would have to pay a share of building the new plant, and it would have to sign a 40-year, open-ended contract in which Santee's share of operating costs could rise every year.

Roy Stoyer had another idea. He was the manager of the Santee Water District, working for the five-member board that would have to make the decision on the problem. He knew what poorly treated sewage dumped in the ocean could do to the beautiful San Diego beaches, so he could not in conscience recommend the Metropolitan Sewer System option. He reasoned that the town was already paying a high price for Colorado River water, which was used once and then thrown away as sewage. Moreover, the cost of throwing it away was high, since it required expensive treatment first. Getting enough fresh water was already a problem, with many water uses restricted by high costs. Since the waste water had to be treated anyway, why not keep it in town and develop ways of

reusing it for some of these needs? He spoke of places to swim and fish, a golf course, water to irrigate crops. The Santee Water District Board had a lot of faith in their manager. They voted to reject the Metropolitan Sewer System plan and give Roy Stoyer a chance to pioneer in water reclamation.

MORE ACTION

Over the next few years, Roy Stoyer and his staff accomplished some outstanding things in the annals of sewage treatment:

1. They supplemented the existing system's treatment with natural oxidation and filtration processes. This involved pumping treated waste water through a series of ponds and then filtering it through 50- by 100-foot beds of sand and gravel. This system removed 99 percent of the remaining pollutants. It cost little to set up and operate, and it caused no new pollution problem.

2. Public willingness to accept the "second-hand" water was courted by an extensive public speaking schedule, carried out personally by Roy Stoyer. A pond landscaped and equipped with picnic tables and barbeque pits attracted notice, but it was fenced in "until the water is proven safe." By 1961, when state approval for picnicking and boating was given, thousands of people were eager to come and enjoy the pond.

3. The Regional Water Pollution Control Board required proof that viruses were not surviving the treatment process before it would allow fishing and swimming in the ponds. Technology to do this was not available. Roy Stoyer was able to develop support for a research program involving the U.S. Public Health Service, the California Departments of Health, Water Resources, Fish and Game, the Water Quality Control Board, and the San Diego County Department of Public Health.

As a result, a three-year study of virus contamination and removal in sewage treatment was carried out at Santee.

RESULTS

By 1965 health authorities were satisfied that the Santee water was safe for fishing and swimming.

New technology for monitoring viruses in sewage was developed.

Reclaimed water was used to irrigate a new golf course.

By 1966, 100,000 people were using the recreational ponds.

Santee residents voted a $2,305,000 bond to pay for a new tertiary sewage treatment plant.

By 1970 Santee had eight recreational lakes, two golf courses, and over a thousand acres of agricultural land in production, all using second-hand water.

This was the world's first example of how a community's sewage can be reclaimed and reused by people, with complete acceptance by the public. Windhoek, Southwest Africa, imitated the Santee project. Officials from the dry countries of Israel and India have been especially interested. Santee was amazed at the significance of its home-town project.

STUDY QUESTIONS

1. What were the options available to the people of Santee when the California Water Resource Control Board raised the purity standards for sewage discharge?

2. What problems would you predict in using reclaimed water?

3. How much of what Roy Stoyer did do you think was beyond the requirements of his job as manager of the Santee Water District?

4. At what points were his efforts critical to the success of the Santee project?

5. What is the significance of this project for water supply in other parts of the world?

REFERENCES

Stevens, Leonard A. The Town That Launders Its Water. New York: Coward McCann & Geoghegan, Inc., 1971.

CASE STUDY #8: WATER QUALITY

Too Much Salt

THE PROBLEM

In colder parts of the United States icy streets in winter are a driving hazard. But the practice of deicing streets with road salt has turned out to cause health hazards in local water supplies.

Shortly after World War II, the Massachusetts Department of Public Works tried mixing salt into the sand used on highways after big ice storms. It worked! The ice melted, and driving was less difficult. The "more is better" idea took over. Heavier and heavier doses of salt were used in subsequent winters. Towns began to use salt on local streets. Businesses salted their parking lots. Home owners salted driveways and sidewalks.

This salt was washed away with surface run-off when ice and snow melted. It would then leach into the ground water of the area. By the 1960s, high salt concentrations were showing up in well fields and making them unfit for drinking water. This salt is sodium chloride, the same salt we use on the table.

Burlington, Massachusetts, is a community that grew rapidly after World War II. In 1949 it began developing a well field with 70 interconnected wells in a large sand and gravel aquifer. That same year Route 128, a major highway, was built. It passes by Burlington about 3,500 feet uphill from the well field. In 1961, the town highway department began to store salt in an uncovered pile about 400 feet uphill from the well field. By 1963 there was too much salt showing up in the well water.

HEALTH EFFECTS

Sodium from the salt is a problem in controlling various medical conditions. These include:

- cardiovascular diseases such as hypertension, hardening of the arteries, and congestive heart failure;
- kidney and liver ailments;
- complications of pregnancy, including edema, toxemia, and circulatory problems.

Persons on hormone therapy also need to avoid sodium. This includes cortisone and birth control pills.

ACTION TAKEN

In 1968 Burlington built a storage shed for the road salt. In 1970 Burlington banned use of deicing chemicals on the city streets. At the same time it complained to the Massachusetts Department of Public Works about the amount of salt being used on Route 128.

The state Office of Environmental Affairs began an investigation. By January 1977, over 100 water supplies with unsafe amounts of sodium were found in Massachusetts. The American Heart Association and the Department of Public Health joined in a campaign to get the use of deicing chemicals banned, or at least reduced.

This developed into a safety versus ecology debate, which still goes on. The highway people maintain that there will be more serious traffic accidents on icy roads without salt, and that using sand alone won't work because it would require a change in driver habits to be effective. The environmental people maintain that a water supply is a basic resource which must be preserved for human use, and that any activity that makes it unfit to use must be stopped. Other salts that are as effective in controlling ice on roads are more expensive than sodium salts and therefore less likely to be used for economic reasons.

The Massachusetts DPW reduced the salt applications on the highways. The Office of Environmental Affairs started a program to help towns build salt storage sheds to reduce leaching problems. They also ran workshops for town officials to talk about the problems and recommend similar controls. But the state legislature has passed no regulations to limit use of salt or require permanent protection of supplies.

According to the Massachusetts Audubon Society's research office, the state and local departments of public works represent only one-third of the salt users. They say that small users--private home owners and businesses--account for the rest. Even if all of the salting in Massachusetts were stopped immediately, it would take 25 to 50 years for the large quantity of salt in the ground water to go down to a safe level.

RESULTS

Well fields for drinking water were closed in many towns.

Some measures were taken by some towns to reduce run-off problems and to limit the use of salt on roads.

Public education programs were set up by health and environmental agencies.

Public safety agencies reacted to pressure from public and private groups.

No permanent solution has been found to date.

STUDY QUESTIONS

1. Does sodium in the drinking water threaten everyone's health? Explain.

2. What are the arguments for safety? For ecology?

3. What steps would you recommend be taken on this issue?

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The Case of the Killer Smog

THE PROBLEM

The air of London, England, became a deadly menace to the people on Friday, December 5, 1952. Static weather conditions prevented the formation winds, which normally swept air pollutants out of the city. A black fog blanketed greater London for five days, creating the greatest air pollution disaster ever.

On the first day the smog was so thick and black and pervasive that moviegoers could not see the screen, nor could they hear the sound track because people coughing drowned it out. Buses had to be guided by a person walking ahead with a flashlight. There were many more motor vehicle accidents than usual. At the racetrack the dogs could not see the mechanical rabbit to chase and ran astray, confused and uncertain. Prize cattle, brought to London for a fair, stood with their mouths open, panting, struggling to breathe. Thirteen cows and bulls died of acute respiratory distress or heart failure.

By the second and third days, London hospitals could not take care of all the people trying to get in. People with heart and lung conditions were especially affected, but all age groups suffered. During the five-day period deaths of babies nearly doubled; deaths of children from 1 to 14 increased by a third; for people 15 to 44, the death rate went up by two-thirds.

One reporter wrote that "on the third day of the fog, old men sat down on the curb and died." This was no exaggeration. Medical reports showed that 28 people were caught suddenly by death on the street or at their jobs.

At the end of the five-day siege, well over 4000 excess deaths had occurred, mostly from respiratory problems. Eighty-four percent of those who died had prior heart or lung diseases. For every one who died, hundreds were made ill.

HEALTH EFFECTS

Sulfur oxides and soot from the burning of coal interact to produce the effects of deadly London black smog. Small amounts of sulfur oxides in the air normally are absorbed by the mucous lining of the nose. When soot prevents this cleansing process, the acidic sulfur fumes go deeper into the chest and irritate the bronchial tubes and lungs. This causes severe coughing, and, in due time, bronchitis, pneumonia, and emphysema. Persons already suffering from lung conditions are affected more rapidly than healthy people. Because struggling for breath causes a severe strain on the heart, the effect on persons with a weak heart is disastrous.

These effects are dramatic when weather conditions and heavy pollution combine to create a killer fog. Less severe effects from long-term exposure to these pollutants can lead to chronic respiratory diseases. A connection between air pollution and lung cancer is suspected, but it has not yet been proven.

ACTION TAKEN

This was not the first time that London suffered from black fog. As early as 1306 attempts were made to regulate smoky air from the burning of coal. There were complaints about "sulfur" in the air in Shakespeare's time. Matters got worse with the coming of the Industrial Revolution. The first air pollution disaster to receive worldwide attention was in London in 1873, when more than 1,100 people died. There were more disasters in 1880, 1882, 1891, and 1892. Indeed, all of Great Britain seemed subject to the problem. In 1909 Glasgow had a series of Black Fogs that left 1,063 Scots dead.

Following the London killer fog of 1952, the British government appointed the Beaver Committee to make an official study of the problem. The committee, in due time, reported that the smog was due largely to smoke from domestic coal fires and not primarily from industry. Sulfur dioxide fumes came from both home and industry. The committee found that air pollution was costing the nation $625 million annually. Another major item was health effects, especially bronchitis. The death rate from respiratory diseases was much higher in British urban areas, and higher in Britain than any other country. The conclusion: air pollution is a chronic long-term hazard for the urban industrial population, with disaster potential from serious smog episodes.

In 1956 London experienced another killer fog, with nearly 1,000 dead in a single day. As a result of the Beaver Report, the Clean Air Act of 1956 was passed by the British Parliament. This enabled local authorities to establish smoke control areas and to provide financial aid to home owners who had to convert their heating systems to smokeless fuels. It was up to local communities to take advantage of this opportunity to clean up their air pollution.

RESULTS

The Clean Air Act first went into effect in London, with spectacular results. There was 50 percent more sunshine in the winter and better visibility at Heathrow Airport. Birds returned to the city, and flowers grew again. Buildings were cleaned and stayed clean for years instead of days.

But adverse weather conditions are not so easily changed. There have been five more deadly smogs in London, each killing at least 250 people. But at least this is an immense improvement over previous disasters.

The battle against smoke in Britain has been won in the worst places, but progress has been slower in other areas.

With a decrease in the impact of the disasters, there is a lower level of public concern and little recognition of individual responsibility. Meanwhile, with more sunshine acting on the exhaust of more cars, a new air pollution hazard may be replacing the old. Photochemical smog--the Los Angeles type, caused by sunlight acting on polluting substances--has been detected in England.

STUDY QUESTIONS

1. What group of people suffered the most from the effects of the Black Fog? How do you explain this?

2. Why would the British Isles have so much trouble with killer fogs?

3. Have you experienced breathing polluted air for any length of time? Describe the incident, and how it made you feel.

4. Research project: Many cities and industrial centers around the world have had similar air pollution emergencies. Find out what happened in one or two other places and compare with the London smog of 1952.

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CASE STUDY #10: AIR QUALITY

The Case of the Elusive Villian

THE PROBLEM

Smog invaded Los Angeles somewhat abruptly following World War II. At first, it was a bit of a joke to the rest of the nation, and even to the residents of Los Angeles itself. People in the area spoke of it with a kind of perverse pride, as one reflection of the sudden boom following the war. The new prosperity provided a high standard of living for the growing population, so it was easy to make light of the smog. But it soon passed the point of being funny.

On smoggy days, when lack of wind let the mucky haze hang over the city, everyone complained of burning eyes and runny noses. There was a lot of throat irritation and coughing. Headaches were common, and many people found it hard to concentrate. Poor visibility led to more traffic accidents.

More persistent problems appeared, too. Farmers found that damage to their vegetable crops caused financial losses. People who suffered from asthma, bronchitis, emphysema, or other respiratory diseases found the air intolerable, even on relatively clear days.

Smog was definitely not funny any more. The trouble was that no one really knew what smog was or what was causing it.

HEALTH EFFECTS

Los Angeles smog is the photochemical type, which comes from oxidants, substances that are produced from a mix of pollutants in the presence of sunshine. The United States Environmental Protection Agency has determined that the oxidant in a community's air should not be more than .08 parts per million of air for more than one hour, once a year. Industry says this standard is unrealistically low. Medical people say it is too high.

- Long-term national studies have shown that healthy people suffer eye and nose irritation when oxidant levels are somewhat below the standard.
- Headaches increase when levels are slightly above standards.
- Increase in chest pains and coughing occurs.
- Asthmatic attacks increase.
- Lung function is impaired in exercising persons.

When oxidant levels reach twice the national standard, longer-term exposure to oxidant-laden air produces a decrease in lung capacity, chest discomfort, windpipe irritation, and a decrease in sharpness of vision, especially night vision.

It is not proven that photochemical smog causes an increase in deaths, although it clearly increases physical discomfort and aggravates diseases already present. Many cities in the United States exceed the established standard for more than 100 hours per year. And if there is wind, the pollutants can be carried 50 miles or more into surrounding rural areas.

ACTION TAKEN

It took twenty years of research for answers to the questions, "What is this smog?" and "What causes it?" to emerge.

While scientists carried on their investigations, Los Angeles officials attacked the problem from all directions. Oil refineries were ordered to install scrubbers to remove all sulfur dioxide and hydrogen sulfide fumes. Old factories and new industrial plants were required to have control equipment. Burning of coal was totally outlawed, and oil burning was restricted to six months of the year. Incinerators were banned. "On one day in 1958 we knocked out $48 million worth of incinerators," a city official stated. "No one was allowed to burn anything, not even weeds." These measures helped some, but the problem was still out of control.

Finally, the researchers were able to show the politicians that the smog was not the simple smoke-and-fog mix of London fame. They found that the chief culprit was neither industry nor home fires, but the car. The smog was produced by action of sunlight on gases from the exhaust systems of autos. During the 15 years that this was going on, Los Angeles housewives started a citizen action group called S.O.S. (Stamp Out Smog). Their concern was for the health of their children, which they felt was threatened by the smog. They studied and researched the subject until they were able to speak with confidence and authority. Then they went to the state legislature, sometimes wearing gas masks, and demanded strict controls. Their organization grew and developed political clout, becoming a statewide power.

RESULTS

California passed laws requiring pollution control devices on cars in 1960. This makes cars somewhat more expensive in California, and reduces mileage by two or three miles per gallon. But the voters seem to be satisfied with the law.

In Los Angeles and other urban areas of California, oxidant levels in the air were brought under control but not eliminated. Smog continues to plague Los Angeles, but severe incidents are not as frequent. This is a reasonably satisfactory outcome, considering that the population and therefore the number of cars has increased enormously during the years since the passage of the law, but the situation still requires constant vigilance.

STUDY QUESTIONS

1. It took a long time for Los Angeles to figure out what to do about the smog. What reasons can you think of for this?

2. Why do you think industry would feel the EPA standard for oxidants in the air is too low?

3. List some health effects found even when oxidant levels are below the standard.

4. What are some reasons that people would object to having pollution control devices on their cars?

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CASE STUDY #11: AIR QUALITY

What Goes Up Must Come Down

THE PROBLEM

The first warning came from Sweden in 1972 in a report on acid rain to the United Nations Conference on the Human Environment. The Swedish report listed the findings of 20 years of research on Scandinavian air pollution from the factories of England and Europe: massive fish kills, hundreds of dead lakes, crop and forest damage, corrosion of property, and health implications. Recognizing that acid rain could be an environmental disaster, Sweden warned that similar conditions of industry and weather patterns in Canada and the northeastern United States could lead to the same pollution problems. The Swedish report urged a detailed study of the possibility of such an occurrence in America.

The warning was largely ignored until 1978, when a Canadian study showed that 40 lakes in Ontario were dead and 100 more were in bad shape. At the same time United States fish and wildlife biologists discovered identical problems in the Adirondack lakes in New York. Acid rain is turning out to be a gruesome example of that old adage: what goes up must come down. North America's industries, power plants, and automobile engines release over 30 million tons of sulfur dioxide and nitrogen oxides into the air annually. When these oxides mix with water vapor in the air, they slowly turn into a fine mist of sulfuric and nitric acids. These mists are blown by the wind for hundreds and even thousands of miles, and come back to earth mostly to the north and east, afflicting Ontario, Quebec, and Nova Scotia in Canada, the Adirondacks and all of the Atlantic Coast in the U.S. In fact rain is continuously acid to a destructive degree in all of North America east of the Mississippi River from Hudson Bay to the Gulf of Mexico. Scientists are just beginning to understand how this affects the environment and human health.

HEALTH EFFECTS Direct human health effects from acid rain are considered doubtful by medical authorities. Still, the probability of dying from air pollution-related diseases is significantly higher in the Northeast than in the rest of the United States. Extensive data confirm that the fine sulfate particles involved in acid rain are associated with direct effects on human health, from serious respiratory and cardiovascular disease to cancer. These health effects include increased frequency of asthma attacks, worsened symptoms in cardiopulmonary diseases, decreased lung capacity in school children, and acute and chronic respiratory diseases in both children and adults.

Studies have shown that the above health problems are found at far lower levels of sulfuric acid and sulfate particles than for the original pollutant, sulfur dioxide. This is because of the very tiny particle size of the sulfates, which allows them to be carried deep down into the lungs.

Indirect health effects include damage to drinking water supplies. Water supplies are damaged by acid rain in different ways. Some of the lakes which have become highly acid are sources of drinking water, and the water should be treated to reduce its acidity. When acid water flows through the lead pipes found in older homes, it corrodes the pipes, resulting in dangerous concentrations of lead in the drinking water. This can affect the nervous system, especially in children. Lead can also be leached from the solder that joins copper pipes in newer homes.

Acid rain can leach metals such as lead, copper, and aluminum into water supplies. Metals leached into surface waters can make fish unfit to eat, even where the fish are not harmed by the acid level. Mercury is known to accumulate in fish. Mercury concentrations hazardous to human health have been

found in fish from lakes far from sources of industrial pollution. It is assumed that acid rain affects mercury cycling and increasing mercury uptake in fish.

ACTION TAKEN

To date, the problem is not taken seriously by political and industrial interests. Spokesmen for power plants and the Department of Energy argue vigorously against the need to control acid rain. Some claim it does no harm; some even deny that it is really acidic. More responsible spokesmen for the power industry admit that acid rain is causing damage, but insist that much more research is needed before control is justified. It is true that the acid rain phenomenon is not well understood, but even ten more years of research will not satisfy all the arguments advanced by opponents of control. There is already ample evidence of damage to the environment and human health to justify starting a control program.

What is happening instead is a major shift toward burning more coal by industry and power plants to help solve some of our energy problems. This will increase sulfur dioxide emissions and cause even more acid rain to fall. Furthermore, Congress in 1970 exempted existing power plants from the regulations of the new Clean Air Act, leaving them free to emit sulfur dioxide in volume until well into the next century. In 1980 Congress required conversion of many existing plants to coal-burning, worsening the pollution problem.

RESULTS

The area of the United States affected by acid rain continues to extend southward and westward. Almost all of the eastern half of the country is affected, and trouble spots are developing in the western half. The United States and Canada are attempting to negotiate an agreement on guidelines for acid rain pollution control.

STUDY QUESTIONS

1. Why is the acid rain problem so much worse in the northeastern United States than in the rest of the country?

2. What are some possible reasons for the spread of the acid rain problem?

3. What are some precautions you might want to take to protect yourself from the effects of acid rain?

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CASE STUDY #12: AIR QUALITY
The Invisible Menace

THE PROBLEM

Radioactive pollutants are like time bombs. The effects take many years to emerge and may cause damage great distances from the source. For example, radioactive fallout from a Chinese above-ground nuclear test in September 1976 caused an estimated 300 infant deaths in the northeastern United States. Cows in the region ate grass that had been washed by radioactive rains. This resulted in levels of radioactive iodine in the milk that were 300 to 400 times higher than normal. In the first quarter of 1977, infant mortality rose as much as 41 percent in affected states.

In another instance, American scientists exploded a nuclear bomb on the pacific atoll of Bikini in 1954. Miles across the ocean on the atoll of Rongelap, 82 natives were peacefully living their lives. A sudden shift in the wind carried the radioactive pollution straight towards them. Within 48 hours they were evacuated from the atoll. Ten days later most of them showed radioactive burns. Ten years later some were still developing symptoms of radioactive poisoning.

These examples show what exposure to abnormal levels of radiation can do to human beings. Such fallout from nuclear weapons represents only one source of possible problems from radiation. We must also be concerned about the amount of radiation exposure we get from medical and dental x-rays, about the possibility of nuclear power plan breakdowns leading to radiation exposure, about occupational exposure when mining and processing nuclear fuel and reprocessing spent fuel elements, and about safe storage of radioactive wastes. All this is in addition to the radiation naturally present in the environment.

HEALTH EFFECTS Like other air pollutants, radioactive materials can travel thousands of miles from their point of origin. Effects of exposure vary in severity with intensity of the source and duration of the exposure, but researchers are still investigating the long-term health effects of low-level exposure. Observed effects include severe burns, loss of hair, pigmented moles and other skin abnormalities, tumors and cancers of the thyroid and other glands, damage to nervous systems, and death. It is known that in sufficient doses radiation can cause damage to human cells that results in various cancers. These unseen and unfelt rays can affect genes, causing birth defects or mutations in future generations.

ACTION TAKEN As a consequence of incidents like the Bikini atoll case, a treaty banning above-ground nuclear testing was signed in 1963 by the United States, the United Kingdom, and Russia. Unfortunately not all nations signed, leaving open the possibility of future problems like the effects of the 1976 Chinese test. Eventually the Nuclear Regulatory Commission set an "acceptable" limit on nuclear exposure for each year, but it is not known what constitutes a safe level.

Widespread concern over the possible hazards of nuclear accidents from power plants, the problems of storage of nuclear waste, and the awesome prospect of nuclear war has resulted in formation of many active citizen groups that believe that the government is not fully honest about what it knows about nuclear safety issues or careful enough about what it does. These groups include the Union of Concerned Scientists, an MIT-based public interest group that battles the American nuclear establishment on issues of power plant safety and waste disposal; Physicians for Social Responsibility, a medical group that fights for abolition of nuclear weapons; and the various Clamshell, Abalone, and other alliances that work to prevent construction of more nuclear power plants. Through their informed and persistent action, the members of

these groups have forced industry and government to become more open about conditions in the nuclear industry and to give more attention to safety precautions.

The problems of safe disposal of radioactive wastes have been the object of intensive research and planning. The waste is dangerous to all plant and animal life, and can't be burned or eliminated by the addition of chemicals. The only solution seems to be to store it where it cannot come in contact with living things for centuries. It has to be put where containers will not rust or corrode, and where events such as earthquakes will not accidentally expose it.

RESULTS

Radiation in the air increased less rapidly after the signing of the Nuclear Test Ban Treaty. The controversies surrounding nuclear energy have slowed down the scheduled building of many power plants and stopped others completely. Costs of construction have made nuclear power so expensive that it is no longer attractive from an economic point of view.

Intensive research into safe disposal of radioactive wastes has not yet provided an acceptable solution to the problem. Currently, methods of injecting them deep underground are being investigated. Meanwhile, these wastes are being stock-piled at "secure" disposal sites around the country and causing increasing concern to the power industry as well as the general population.

STUDY QUESTIONS

1. When there is evidence that serious harm to public health is possible, does the public have the right to halt a commercial project before harm is proven beyond doubt?

2. Does industry or government have the right to proceed with a project before safety can be proven?

3. Given that the use of coal and oil for power has produced much more widespread hazards and pollution problems than the use of nuclear power has to date, how do you feel about the risks involved in developing nuclear power?

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CASE STUDY #13: AIR QUALITY

What's Bad for Bugs...

THE PROBLEM

The death of his neighbor was very upsetting to Mac Corbin, a small farmer from southeastern Louisiana. George Maggio died ten days after spilling 2,4D, a chemical herbicide, on his groin area in March 1979. Mac felt there was nothing on the label that warned of the real dangers of the substance. Medical literature had reported nerve damage in humans hours or days after simple exposure of the skin to 2,4D, as in spraying. But the label simply used the word 'caution,' indicating a low-order toxin. The literature also noted that the delicate skin in the groin area can absorb nearly 100 percent of the 2,4D to which it is exposed. George might as well have been drinking it. When he became weak, with chest pains and breathing difficulty, the local hospital emergency room would not treat him. They did not think he was sick enough, and they scheduled him to return for tests the next week. By then, he was dead.

Agricultural pesticides are chemicals used by farmers to kill weeds, fungi, rodents, and insects that harm their crops. They are usually sprayed or dusted on fields or orchards, and they came into widespread use for pest control following World War II. It was customary on large farms to use small airplanes to treat the fields. Everything got covered with the chemical.

It is only in the last ten years that serious concern with the effects of pesticides on human health has developed. As the number of proven pesticide poisonings grew, it became all too clear that what was bad for bugs was not necessarily good for people.

The EPA Office of Pesticide Programs did a national survey in 1972 of hospitalized cases of pesticide poisoning. They found that in 3,000 hospital cases there were twice as many farmers

and farm workers as any other group. A repeat of the study in 1975 found that there were 54 percent more farmers and farm workers hospitalized for poisoning than in the previous study, while the number of other people stayed the same. This might have been because the true cause of the illness was better understood, and more farm people were being properly treated.

Another study by the University of South Carolina found that the average doctor treated 15 cases of pesticide poisoning for every one sent to the hospital. This means that possibly 45,000 people are poisoned by pesticides each year.

Even with the ban of some of the most toxic substances, beginning with DDT in 1973, the number of proven pesticide poisonings continues to grow. How widespread a problem it is may not be known for some time. Edwin Johnson, deputy administrator of the Office of Pesticide Programs, stated:

> When the issue is discussed with migrant workers' representatives, it is an exceedingly serious problem and there are unwarrented exposures to workers through fairly large scale misuse of pesticides. When you talk to growers' organizations, it's an incidental problem.

HEALTH EFFECTS

Pesticides can enter the human body through the lungs or through the skin. They interfere with the enzyme needed for proper relaying of messages through the nervous system. This leads to blurred vision, mental confusion, heavy sweating, stomach cramps, nausea, dizziness, chest tightness, breathing difficulty, and in bad cases, death.

Some pesticide chemicals have long-term effects, taking 10 to 20 years to develop. These include male sterility, birth defects in children, cancers of various types, and genetic damage.

People differ in their body's reaction to pesticide poisoning. What would kill one person might only make another person ill.

The government considers many of these chemicals 'safe' because of the low amounts of contact workers have with the substance. Many scientists believe that any exposure to a cancer-causing chemical is a health hazard.

Acute pesticide poisoning occurs mainly among farm workers and among children who are exposed accidently.

ACTION TAKEN

Knowledge of the dangers of pesticides to human health grew rapidly in 1968 and 1969. In response, federal and state agencies began to restrict or prohibit the use of some of the most dangerous substances, such as DDT and dieldrin. Even so, it took until January 1973 to effectively ban the use of DDT in the United States. This has not stopped the manufacture of these substances for export to farms in others part of the world.

Congress passed several laws and set up programs to bring the use of toxic chemicals in the environment under control. These include the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) of 1972, which directed EPA to protect against "unreasonable adverse effects" on humans or environment. This act required the registration of every pesticide in the United States with EPA, required industry to prove the safety of a new pesticide before marketing it, and required an EPA registration number and prescribed labeling for every pesticide. The Toxic Substances Control Act of 1976 set out to inventory all of the chemicals presently in production in the United States. The list reached 70,000 in 1978 and is still growing. The EPA supported programs to help deal with farm workers' problems. A Pesticide Applicator's Certificate was required of farmers by October 1977. A Pesticide Incident Monitoring System was set up to gather information on everything from farm worker poisonings to fish kills, and to respond to inquiries from concerned citizens. A waiting period of 24 to 48 hours before workers can reenter treated fields was prescribed for twelve commonly used pesticides. A joint EPA-HEW

program was begun to train health personnel who work with farm families to recognize and treat pesticide poisoning. A slide show and educational materials for migrant workers were developed to teach migrant workers how to protect themselves and what to do in case of a poisoning incident.

The government and industry both supported a new program of Integrated Pest Management (IPM). This program combines the use of smaller amounts of chemicals with other methods of pest control. It relies on such natural controls as farming methods, pest diseases, resistant crop varieties, sterile insects, sex attractants, encouragement of predators and parasites, and the use of chemical pesticides only as needed.

RESULTS

According to Mac Corbin's testimony at the Texas Regional Pesticide Forum (April 20, 1980), these measures are not effectively carried out. In his statement he described the Pesticide Applicator's Certification program he attended as not seriously taught, with certificates passed out to every one who attended the two-hour session. He felt that labels, such as on the 2,4D that killed his friend, did not adequately portray the danger of the chemical, and that health personnel in the local hospital were not trained to recognize and deal with pesticide poisoning cases. This was five or more years after the laws were passed and programs mandated. Continued input from people like Mac Corbin is needed as a means of making the responsible agencies do a better job.

Two developments are making for a more hopeful situation. One is the greater knowledge and understanding that many farmers and farm workers have of the dangers of pesticide use. This is due in part to EPA education efforts, and in part to the work of the National Rural Health Council, a part of Rural America (a national organization that works to promote better health services and regulation enforcement for small-town and rural people).

The Integrated Pest Management program is an alternative viewed by government and industry as safer, less costly, and more efficient than total reliance on pesticides. A five-year farm demonstration project currently underway will show how IPM works on selected farms. Farmers and growers hooked on chemical pesticides argue that IPM is too costly, but many experts believe the opposite is true. This practice fits with the growing movement for organic farming. Many farmers have come to the conclusion that too much dependence on chemicals--fertilizers as well as pesticides--is bad for the soil, and they are reviving organic methods of growing crops and livestock. They are already practicing and advocating IPM.

STUDY QUESTIONS

1. Why did farmers develop such a total dependence on chemical pest controls?

2. Given that most farmers must now be aware of the hazards of pesticide use, why do they continue to use them?

3. Do you think it is all right to export products for use in other countries when they are considered too dangerous for American use? Explain your answer.

4. These same pesticides are used in home gardens and around the house for pest control. Find out whether there are any of these substances in your home and whether they are properly stored and used with necessary precautions.

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CASE STUDY #14: AIR QUALITY

The Case of the Terrible Air

THE PROBLEM

In 1962, Dr. Leonard Greenburg, professor at Albert Einstein College of Medicine, startled the New York City population with a report that nine years earlier in November 1953, an air pollution disaster caused the death of 200 New Yorkers and made thousands more ill. Dr. Greenburg discovered this in going over the city's death records. The fact emerged that in 1953 an epidemic of illness and death coincided with a temperature inversion that had lasted for ten days. New Yorkers were so used to bad air that they never connected the extra deaths with a little more of it.

In 1963 another temperature inversion killed 200 people, and another incident was responsible for 168 deaths in 1966. New Yorkers could no longer joke about the smog in Los Angeles. The evil stuff had invaded their own city.

Hazel Henderson, a young mother in New York City, was angry. "I grew up in England, and I saw what happened during the terrible fog in 1952," she said. "When I came to the United States, I was sure that nothing of the kind could happen here. Gradually I realized I had not escaped after all."

In the 1960s, New York City took first place among the nation's cities in sulfur dioxide pollution, and was among the top three in nitrogen dioxide levels. With its heavy traffic, the amount of carbon monoxide in the air was decidedly unhealthy. With regard to dirt in the air, New York had the national record, with an average of 80 tons of assorted particles falling on each square mile of the city per month. (An area is classified as polluted with more than 20 tons of particulates per square mile per month.) So Hazel Henderson had plenty to be upset about.

The pollutants in New York City air include the sulfur dioxide and carbon particles from industrial smokestacks and residential heating, the carbon monoxide, nitrogen oxides and hydrocarbons from auto exhaust, the smoke and fumes from incinerators, and a liberal dose of photochemicals from the action of sunlight on the mix. Any one of these pollutants can do harm. Together, they are many times more damaging.

HEALTH EFFECTS

The major health effects of air pollutants come from irritation of the respiratory tract. These irritants slow down and even stop the cleansing action of the lining of the respiratory tract and leave the sensitive cells underneath the lining open to infection. The airways can become constricted, and bacteria-destroying cells can be paralyzed. Chronic constriction of the airways in response to irritants can result in a condition called "chronic airway resistance." This reduces the ability to breathe.

Correlations between the incidence of respiratory disease and levels of air pollution have been well established. These range from the common cold and other upper respiratory infections through pneumonia. Scientists have also determined that chronic respiratory diseases develop as a result of long-term exposure to such irritants as cigarette smoke, occupational dusts, and air pollutants. Such diseases include chronic bronchitis, emphysema, and lung cancer. The harmful effects of air pollution affect children and elderly people more intensely than average people, and aggravate other health problems such as asthma and heart and circulatory problems.

ACTION TAKEN

Hazel Henderson felt helpless at first. Then, when her little girl started school, she decided to use three hours a day "to do something about the terrible air." She wrote to city officials, government agencies, and radio and television executives. In 1964 she joined with City Councilman Robert Low to form the Citizens for Clean Air, Inc. Within a year there

were 700 members. The group lobbied intensively in the legislature and was active in educating the public on the issues of air pollution. They were able to get time for a one-hour television documentary on air pollution and a series of spot commercials, one of which announced, "Tomorrow morning when you get up, take a nice deep breath. It'll make you feel rotten."

In May 1966 the New York City Council passed a strict air pollution control law. Soft coal heating was outlawed, and no new incinerators were to be licensed. Clean air standards were set. A plan to set up an automatic air pollution index reporting system was funded. The budget of the New York City Department of Air Pollution Control was doubled to $3 million, or about 38¢ per person in the city--not a lot to pay for cleaner air.

This was the beginning of improvement in New York City air, but New Yorkers soon realized that air pollution is a problem that goes beyond political boundaries. It was necessary to involve state and federal agencies in action to control many pollutants at their source. The Citizens for Clean Air continued its efforts to conquer New York City's air quality problems, doing its share to counteract the intense lobbying of industry against air pollution controls. It took years, but the effort is paying off.

RESULTS

The 1980 Report on Environmental Quality states that "Although there is still much room for improvement in New York, there are some encouraging signs." The total number of unhealthful days went down to 174 in 1978, from a previous three-year average of 270. The number of hazardous days fell from 229 in 1976 to 87 in 1977 to only 14 in 1978. Undoubtedly the pollutant control standards set by EPA as a result of the Clean Air Act have a lot to do with this. The efforts of many Hazel Hendersons contributed to getting the Clean Air Act

passed by Congress. It is going to take continuing citizen action to keep it in effect.

STUDY QUESTIONS

1. Why was Hazel Henderson so upset?

2. How does air pollution reduce the ability to breathe?

3. Why is it taking so long for New York City air to improve?

4. Do you think New York City air would have improved without the Clean Air Act? Give reasons for your answer.

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CASE STUDY #15: AIR QUALITY

Inside the Tight Box

THE PROBLEM

One cold winter morning in 1980 a father, mother, and their school-age children were found dead in their beds. The community was shocked. The victims were a normal, active, happy family and no one could believe they would do themselves harm. Yet, there were no signs of violence on the bodies or of an intruder breaking in. Because the house had an attached garage, the possibility of carbon monoxide fumes from a car left running was checked out. It would have been a suicidal event in that case, but it proved to be not what happened. What then did cause this tragedy?

Cases of fatal indooor air pollution in the home are rare. However, there is an increasing risk of such events as people tighten up their houses to conserve energy. Before major conservation efforts like insulating and sealing cracks, the average home had a full exchange of its air with outdoor air about once an hour. With a full conservation effort in effect, the same home may exchange air as slowly as once in five hours. Along with the heated or cooled air, a variety of pollutants may be retained.

Indoor air pollutants include several that are regulated in outdoor air under National Air Quality Standards. Gas stoves and unvented space heaters give off carbon monoxide and nitrogen oxides. Researchers have studied the levels of these pollutants in an energy-efficient house in Walnut Creek, California. They found that while average levels were highest in the kitchen, they were higher than outdoor levels in the living room and bedroom as well.

Formaldehyde and radon gas are two more pollutants than can affect indoor air quality. Formaldehyde is a common ingredient of foam insulation, upholstered furniture, insulated

drapes, synthetic carpets, and other household items. It is also used extensively in the bonding agents of plywood and particle board. One study showed that when furniture was added to an empty house, formaldehyde levels almost tripled. When windows were opened, the levels of formaldehyde dropped substantially.

Radon gas comes from the decay of radium 226. This form of radium is a trace element in most rock and soil, so radon can be produced indoors from many substances. Examples are brick and concrete building materials, as well as the soil under the foundations. Tests have shown that indoor levels of radon are often higher than those found outdoors.

Another indoor air pollutant is the suspended particle concentration found in the home, at the workplace, and in other closed environments. Cigarette smoking causes markedly higher levels of suspended particles in indoor air. Given recent evidence that nonsmokers who are exposed to cigarette smoke regularly do suffer respiratory damage, this is a serious indoor air pollution situation.

HEALTH EFFECTS

Each of the indoor air pollutants has its own damaging effects.

Carbon monoxide reacts with hemoglobin in the blood and interferes with its ability to carry oxygen. Low amounts in the air can cause headache, dizziness, confusion, and fatigue. Large amounts can be fatal.

Continuous exposure to nitrogen dioxide is harmful to the lungs and seems to severely diminish the oxygen carrying capacity of the bloodstream.

Formaldehyde has been found to cause health effects like acute nausea, eye irritation, respiratory problems, and more serious long-term effects like cancer.

The decay products of radon gas are carcinogenic, so there is concern over high concentrations of this pollutant.

Particulates, when fine enough, can travel deep into the lungs and carry other pollutants deeper than they would get on their own. This irritation slows down and even stops the cleansing action of the cilia. Breathing becomes more difficult, foreign matter is not effectively removed, and respiratory infections can more easily gain a foothold.

ACTION TAKEN

The indoor air pollutant problem is just beginning to be investigated. Concern is growing because, for one thing, most people are indoors most of the time. And as people react to the energy shortage with intensive conservation measures, it is necessary to find out how this will affect the quality of their air for breathing purposes. Reports on studies of indoor air pollution are very recent, and it is obvious that much more research needs to be done.

The Consumer Product Safety Commission has designated formaldehyde and urea formaldehyde foam insulation as priority projects, in part, in response to 500 complaints of health problems.

Indoor air quality standards for the workplace are set by the Occupational Safety and Health Administration, but there is no existing authority to set such standards for indoor air in other environments such as homes and schools. It is unclear whether EPA would have authority under the Clean Air Act to extend outdoor standards to the indoor environment. It is also not established whether levels that are acceptable outdoors would be suitable in a confined environment.

It is possible to control indoor air pollution. Particulates can be removed by filters in space conditioning systems or by electrostatic precipitators. Gases and fumes can be controlled by activated charcoal or carbon absorbers. Outside vents on

gas furnaces and appliances can carry both smoke and fumes away.

Another possibility is controlled mechanical ventilation. This system uses a heat exchanger to transfer heat from outgoing warm air to incoming cold air (or vice versa in hot weather) and permits increased air exchange at much lower energy cost than an exhaust fan.

RESULTS

Two things are clear with regard to indoor air quality. One is that people need to be alert to the hazards, and aware of the symptoms caused by the pollutants, so they can deal with an indoor air pollution problem in their home before it causes serious harm to health. The second is that people do have the power to move government to action, for example, those 500 who complained to the Consumer Protection Agency about foam insulation. Especially with so many cutbacks in federal programs, it is important that people continue to let their concerns be known and to require appropriate action from government agencies.

STUDY QUESTIONS

1. Which of the indoor air pollutants do you think might have caused the death of the family? Give reasons for your answer.

2. What dilemma does the indoor air pollution problem present to energy-conscious home owners? What choices do they have?

3. If a person wanted to reduce formaldehyde pollution in his or her home, what are some ways to do this?

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